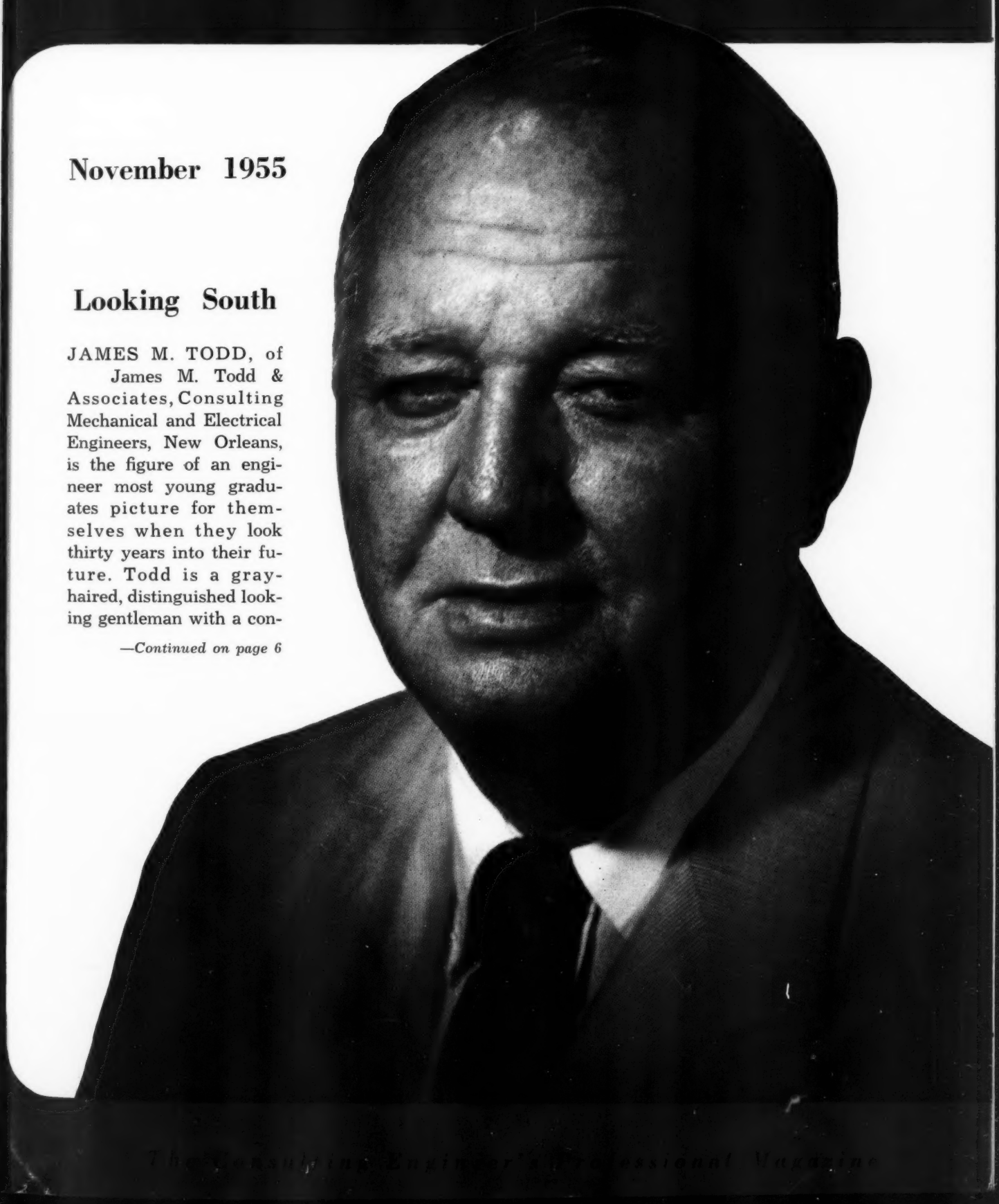
consulting engineer



November 1955

Looking South

JAMES M. TODD, of James M. Todd & Associates, Consulting Mechanical and Electrical Engineers, New Orleans, is the figure of an engineer most young graduates picture for themselves when they look thirty years into their future. Todd is a gray-haired, distinguished looking gentleman with a con-

—Continued on page 6

The Consulting Engineer's Professional Magazine

NEW DIMENSIONS IN CENTRALIZED CONTROL

Two story benchboard controls giant multiple fuel cyclone fired boiler!

The 125,000 KW extension to Raritan River Plant of Jersey Central Power and Light Company can be operated entirely from the compact benchboard shown here. This console, built by Hays and designed by Burns and Roe, Inc., consolidates the necessary control stations and miniature indicators in a small space yet provides easy accessibility for servicing.

In addition, this new design two story benchboard reduces costs three ways:

Lower operating costs—fewer men operate more equipment.

Lower installation costs—entire board fabricated by Hays. Minimum field piping and wiring.

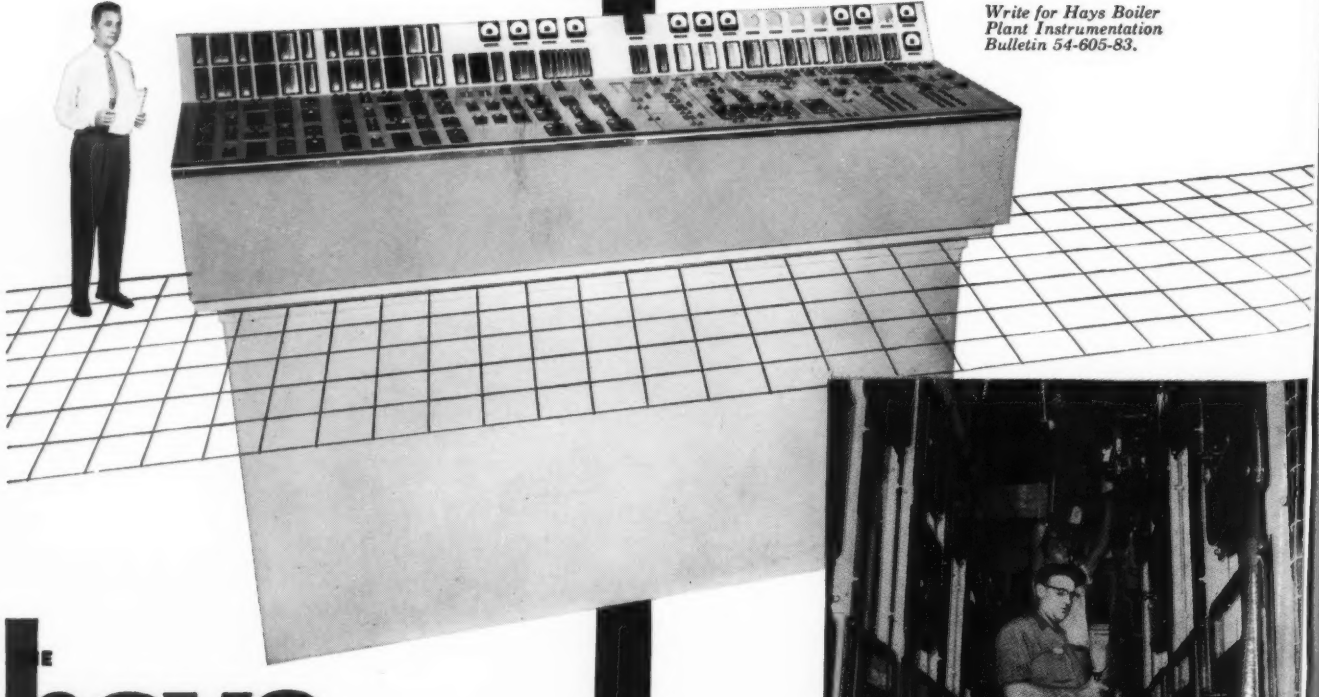
Lower maintenance costs—easy accessibility for maintenance from *inside* the panel (photo below).

Four cyclone furnaces are employed by the pressurized steam generator to deliver 900,000 lbs/hr. of main steam at 2,000 psig, 1050° F. and 740,000 lbs/hr. of reheat steam at 430 psig, 1000° F. The boiler is designed to burn coal and gas in any combination in all cyclones.

A Hays electrically operated combustion control system was selected by Jersey Central. Its electric operation eliminates the need for expensive compressors and dryers and allows maximum flexibility in central control location. Provision has been made in the system for future addition of oil as a third fuel with no loss in flexibility.

Hays paramagnetic type O_2 analyzers with new design sampling systems and electronic recorders are used for oxygen compensation of the control system.

Write for Hays Boiler Plant Instrumentation Bulletin 54-605-83.



Inside view of panel

hays

CORPORATION

MICHIGAN CITY 32, IND.

Automatic Combustion Control • Veriflow Meters and Veritrol • Electronic Oxygen Recorders • CO_2 Recorders Boiler Panels • Gas Analyzers • Combustion Test Sets Draft Gages • Electronic Flowmeters • Miniature Remote Indicators • Electronic Feed Water Controls

VOLUME 6 NUMBER 5

Published by BPA

Consulting Engineer Publishing Co.
227 Wayne St., St. Joseph, Mich.

EDITORIAL

Hunter Hughes

A. M. Steinmetz

J. C. Dean

D. L. Wolf

F. D. Hirschfeld—Zurich, Suisse

ART

Len Sentowski

Jack Knuth

PUBLISHER

E. R. Gauley

BUSINESS MANAGER

F. C. Donohue

CIRCULATION

Loretta Turner

SALES MANAGER

O. DeWitt Young

SALES REPRESENTATIVES

(See page 86)

The Engineering Index Service in Public Libraries lists articles from CONSULTING ENGINEER

CONSULTING ENGINEER is published monthly at 227 Wayne St., Saint Joseph, Mich. Price 1 year $10.00; foreign $15.00; single copy $1.00. Accepted as Controlled Circulation Publication at Saint Joseph, Michigan. Send Form 3579 to Saint Joseph, Mich. Copyright 1955 Consulting Engineer Publishing Co.

consulting engineer®

November 1955

FEATURE ARTICLES

Plant Location Problems 34
Charles P. Wood

These Contract Terms Got Action 38
Norris Matthews

Enclosures for Vital Areas of Outdoor Power Plants 43
Robert H. Weight

Specifying Industrial Waste Treatment 46
R. J. Keating

Planning for Engineering Work 50
Robert B. Wilson and Robert Galloway

Analyzing an Automation Project 55
C. E. Evanson

Should Professional Engineers Advertise? 60
Richard L. Moore

DEPARTMENTS

Personality — James M. Todd ..... Front Cover
Readers' Comment 10
Scraps and Shavings 16
Economic News Notes — *E. F. MacDonald* 18
Atoms in Action 20
The Legal Aspect — *Melvin Nord* 24
Report From Stockholm — *Fritz Hirschfeld* 64
News 72
Men in Engineering 76
Notes From Abroad 78
Books 82
Meetings 85
Advertisers' Index 86

The Consulting Engineer's Professional Magazine

James M. Todd

—starts on front cover

fident, easy manner and the social grace that is his heritage as the son of a sugar planter. He also has the vision and skill of the engineer. He is as much at ease and as much respected in a technical council as he is in a group of civic and social leaders in the reading room of the old Boston Club, on Canal Street. His demonstrated ability as an engineer and his considerable personal charm have combined to make him one of the most honored members of his chosen profession.

Holder of Honors

Todd is a Fellow member of both the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. He was National President of ASME in 1949, the first Southerner ever to be elected to this office. The following year he was elected President of Engineers Joint Council. Currently, he is Vice President of *Union Pan Americana de Asociaciones de Ingenieros* (UPADI).

"I have never thought of myself as a joiner," Todd says, "but joining is a most important part of being an engineer. It is unfortunate that we have so many engineering organizations — some of them overlapping others in their aims and objectives, others failing to do fully the jobs they have set out to do. Because of this multiplicity of societies, I always hesitate to recommend the formation of yet another, and I have refrained from joining some excellent and worthy groups simply because no man can spread his society activities too thin and still be active.

No Organization for Consultants

"Consulting engineers are in a very peculiar position so far as engineering societies are concerned. Most of us belong to one or more of the Founder Societies, the National Society of Professional Engineers, or both. The problem arises from the fact that none of these societies are primarily interested in the problems of private practice. They cannot afford to be. The majority — in fact, the very great majority — of their members are employed in industry. These men in industry are the men to whom the societies owe most and must serve most vigorously. We cannot expect them to spend much time on the specific problems of the consulting minority.

Committees, Divisions, Regional Groups

"There are committees or divisions in most of the Founder Societies devoted to the problems of private practice. ASME has been in the process of reviving a Committee on Private Practice for several years. But consulting engineers are seldom confined in their interest to just one branch of the profession. The Civils, Mechanicals, Electricals, Mining, or Chemicals cannot deal separately with the many problems we face every day in private practice.

"There are also, I understand, a number of regional, state, or city-wide organizations of consultants. These groups could, and may now, serve a most useful purpose. Certainly the idea of organizing consultants into state or city groups is theoretically right, for consultants must be registered by states and must fit their fees and practices to regional standards. On the other hand, these groups are not always so excellent in practice as they are in theory. We have such an organization in this area known as the Gulf Institute of Consulting Engineers, but it has not been supported by some of the larger local consultants, and it has not been as active as it should have been, in my opinion.

Plans for a National Group

"In some other states the situation could be very different. The local association of consulting engineers might be very well supported and quite active. The trouble is that there is no central organization, no communication from state to state, and no unified activity. I also understand that there is some effort toward forming a national association of these state and regional groups. Here, again, the ideal is excellent, but I hesitate to support any new association, no matter how worthy and how needed, simply because I oppose the founding of new engineering organizations — adding to the number of engineering societies — while we are still at work after many, many years of struggle, to try to find some unity organization for the Founder Societies.

"I am frequently discouraged by the slow pace of the Founder Societies in any actions involving change. Take this matter of a headquarters building. We have been at work on this thing for better than two years now.

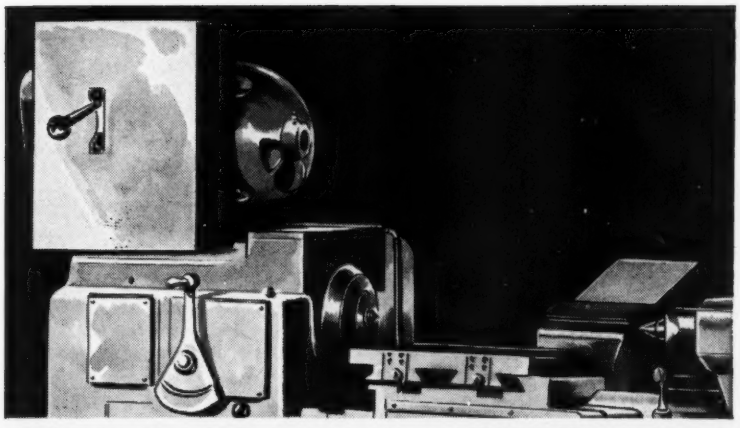
UPADI, — A Unity Group

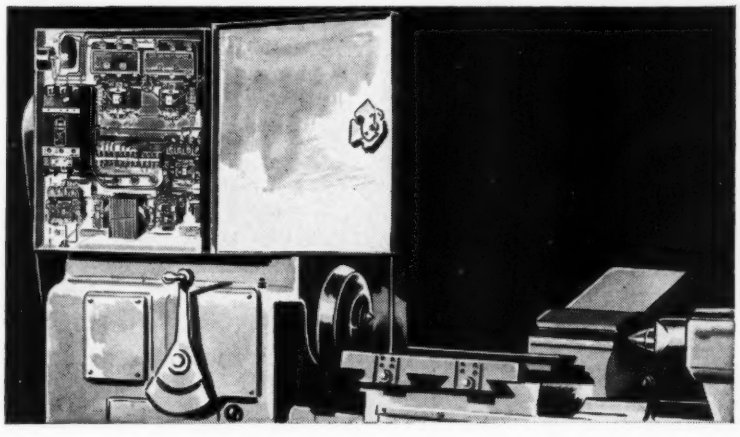
"On this matter of societies, there is one organization in which I am very much interested. That is the *Union Pan Americana de Asociaciones de Ingenieros*, more generally known as UPADI. I am President of UPADI Fund, Inc., the group responsible for collecting the money to operate UPADI. This UPADI organization is an outgrowth of the South American Association of Engineers, which expanded in 1952, to include all of the countries of the Western Hemisphere. Actually, there are no individual members. One representative engineering society in each country belongs to the organization. Canada is represented by the Engineering Institute of Canada, and we by the Engineers Joint Council. But none of these societies pays any dues directly to UPADI. Financial support comes from individual engineers and scientists who are interested in the friendships between the engineers of North and South America, and in providing the opportunity for exchange of information and ideas. ▲▲

The right electrical protective equipment for your machine tools—

Type ETI molded case circuit breakers with operating handle mechanism

For machine tool manufacturers who incorporate electrical protective devices in their products, I-T-E offers a complete line of Type ETI (adjustable instantaneous magnetic trip) molded case circuit breakers rated 3 to 600 amperes continuous, 250 volts d-c, 600 volts a-c, and operating handle mechanisms.



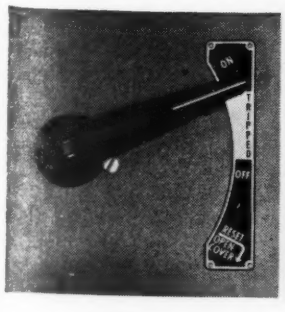


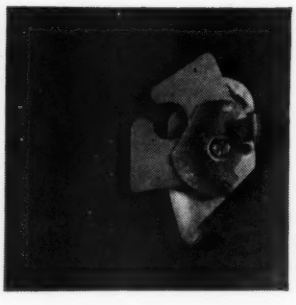
TYPE ETI MOLDED CASE CIRCUIT BREAKERS OFFER THESE OPERATING ADVANTAGES

When applied to motor circuits in conjunction with a properly selected motor running overcurrent protective device, they provide positive protection. Circuit breaker provides short circuit protection with trip setting adjusted slightly above the motor inrush current through medium of external trip adjustment feature. Motor running overcurrent protective device guards against motor overloads.

- Common trip principle opens all poles whenever overload occurs
- Trip-free toggle mechanism prevents breaker from being reclosed against overload or short circuit conditions
- No replacement of parts necessary—anyone may restore service

I-T-E OPERATING HANDLE MECHANISMS OFFER THESE ADVANTAGES





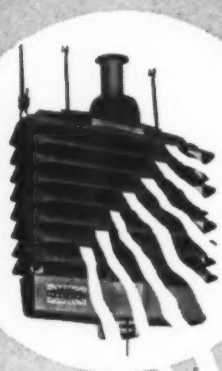
A simplified operating mechanism, easily assembled, which can be readily mounted on front door of control panels; panel preparation requires simple punching or drilling operation; available for all breaker sizes in uniform styling and design.

- Right- or left-hand operation
- Ease of installation—drilling template and instructions provided
- Interlock provisions—door cannot be opened with circuit breaker in "ON" position
- Visual handle indication—shows when circuit breaker is "ON," "OFF," "TRIPPED"
- Slamproof—self-centering spring loaded engaging cam automatically locates breaker handle
- Padlocking provisions—operating handle can be locked "ON" or "OFF"

For more information or catalog literature, write Small Air Circuit Breaker Division, I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia 30, Pa. Or contact your local I-T-E District Sales Office.

I-T-E CIRCUIT BREAKER COMPANY Small Air Circuit Breaker Division

Bring the Sun Indoors!



Your Plant can now have
EFFICIENT, HEALTHFUL HEAT
silent and draft-free
with
PANELBLOC
INFRA-RED UNIT HEATERS

- Comfortably heats workers and machines within radiation area.
- Heat not wasted on air which would normally rise to ceiling.
- No fan, motor or electrical connection needed.
- Never shut down due to power failure.
- Heat delivery cannot be diverted by drafts from open doors.
- No moving parts . . . less maintenance.
- May be used with any commercial type gas fuel.

Remember how comfortable it feels to stand in the warm sun on a cold day? That's how Panelblocs work. Gentle, comfortable heat rays warm everything they touch. You have all the advantages of conventional heaters . . . none of the disadvantages.

Panelbloc uses no fan. This means no drafts (heating is accomplished by guided radiation). With no electrical connections, Panelbloc costs less to install—will continue to operate during a power failure . . . and it heats, not air, but personnel and equipment . . . anything solid.

Panelbloc may be installed in practically any type structure for general heating; for spot heating in an otherwise unheated building; for heating a single room . . . In fact, almost any heating requirement can be solved with Panelbloc. Available in two models: 62,500 btu and 125,000 btu input.

For warm air heating check the Prat-Daniel THERMOBLOC Heater . . . used the world over.

THERMOBLOC
Division of
PRAT-DANIEL CORPORATION
3-11 Meadow St. • South Norwalk, Conn.
Send Me Panelbloc Bulletin P-154
Name_____Title_____
Company_____
Address_____

READERS' COMMENT

Science Fiction . . .

Sir:

Your most excellent publication is always a welcome source of information, and always eagerly read. But this time (September copy) I feel you have done something quite out of the ordinary, and I am not yet sure I understand it right: With respect to the article "Permanent Magnets," I must ask: who is pulling who's leg, or are you serious? I am sure that any E. E. around your parts is able to point out the error in the argument that seems to prove that you can get energy out of an induction generator without putting it in. He will tell you that it is correct that no energy (forgetting friction, eddy currents, hysteresis, etc.) is needed to move the Ferrite (or any other magnet) in and out, as long as the coil is "open" and no current flows through it. But that as soon as there is a current, the magnetic field caused by it will interact with the main field so as to create additional resistance to the motion, requiring added force for overcoming it, and in this way absorbing just the same amount of energy that comes out of the coil.

. . . Such a device would not only be a *perpetuum mobile*, but much worse. A *perpetuum* is at least only supposed to run itself without giving off energy. This thing should give off energy on top of moving itself. . .

Again, I have to refer to page 54, where I find the sentence: "How can this small magnetic unit develop a total attractive force of 50 lb at the pole pieces when each pole of the ferrite has attractive force of only 10 oz?—Will other designs of magnetic units . . . . offer even greater multiples of attractive force?" The answer to these questions has long been given. A coil of wire, of the same cross section as the ferrite, and of the same "H" (Oersted, or amp-turns equivalent) will in itself have very little pulling force. Given a core with the full cross section, the pull will increase, and by cutting down the size of the pole pieces this "attractive force" will still increase to a maximum. The pull of any magnetic pole, (again as any E. E. can tell you) is proportional to the square of induction in the pole piece (B, in Gauss). A rough formula is:

$$F = A\left[\left(\frac{B}{5000}\right)^2\right]$$

where A is pole area in square cm
B induction in pole area in Gauss
F the total attractive force in kg.

It is easily seen that by cutting down the pole area, an increase of pull is obtained, as long as the saturation of the pole pieces does not prevent a further increase in "B." This is where the decreasing permeability puts a damper on. . .

R. T. Erban
Consulting Engineer
Flushing, N. Y.

Sir:

Drat Newton's Third Law! Why can't it be true what you say about magnets on pages 60 and 61 of your September issue?

Perhaps, maybe, your tongue was in cheek. That subhead, "Science Fiction?" looks like it.

Anyhow, I hereby rise to your bait and challenge you to attach those two terminals of the coil pictured on page 60 to an electrical load — any load at all. Even a transistor, say, or a neon glow lamp.

Now joggle the spring so the ferrite block bobs up and down at the end of the spring. What happens?

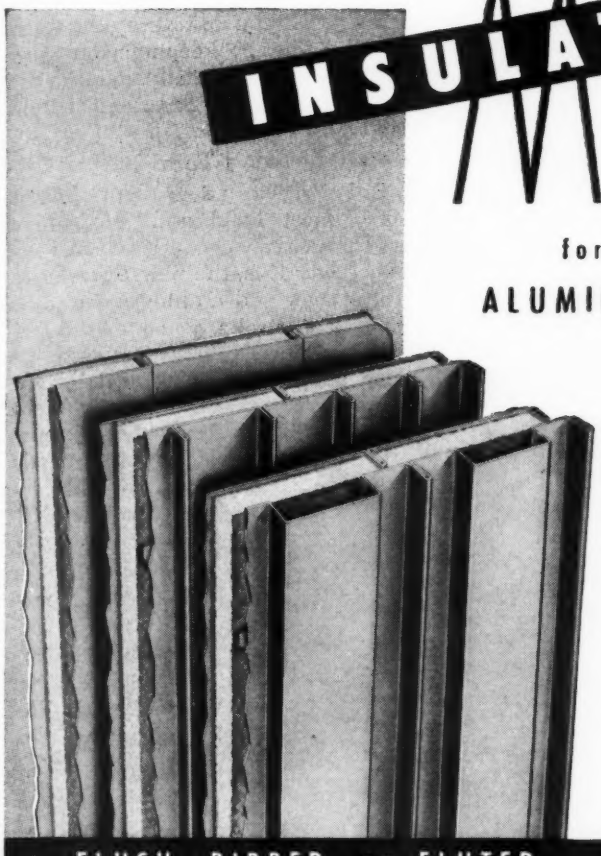
The moment any actual current flows through the magneto windings, you get a damping action. Why? Because the soft steel pole pieces and their soft steel yoke which is the core of the winding become an electromagnet.

The effect of that electromagnet is to yank back on the ferrite block. Long before the unimpeded motion of the spring would cease, your

INSULATED METAL WALLS

for INDUSTRIAL and COMMERCIAL BUILDINGS

ALUMINUM, STAINLESS or GALVANIZED STEEL



FLUSH, RIBBED, or FLUTED

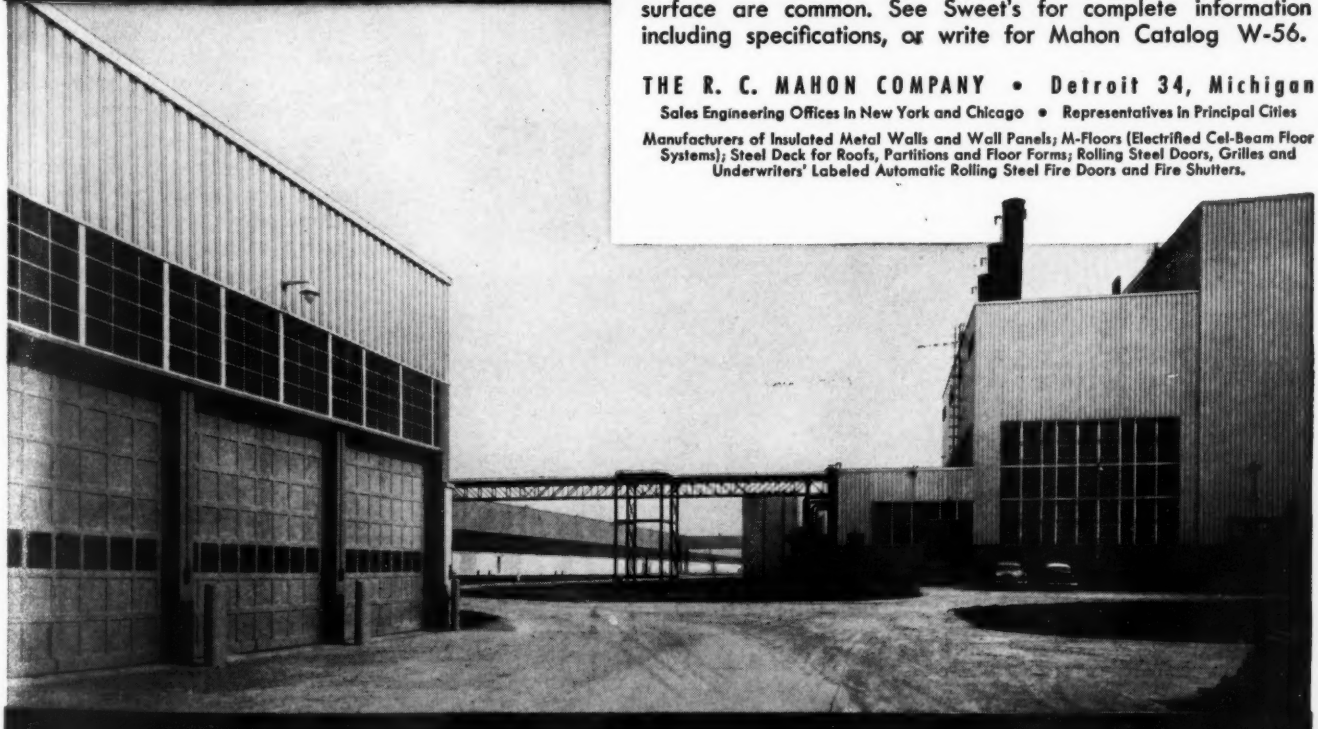
Over-all "U" Factor of Various Types is Equivalent to or Better than Conventional 16" Masonry Wall

More and more architects every day are taking advantage of the low-cost permanence of light weight Stainless Steel or Aluminum curtain wall construction. New buildings and complete industrial plants with bright metal exteriors are appearing all over the country. In the past five years, one industrial concern alone has built nine complete new plants employing Mahon Metal Curtain Wall construction throughout—the plant illustrated below is typical. When you plan your next building, call in a Mahon engineer and let him tell you more about Mahon Insulated Metal Walls . . . let him show you some outstanding examples of architectural treatment in ALL-METAL exterior design, or, if you prefer, some attractive exteriors with metal in combination with brick, glass block or other materials. Have him give you cost figures, too . . . because, in this type of construction, important building economies are realized through lower material cost, lower labor cost, and the cumulative savings and advantages deriving from reduced construction time. Mahon Insulated Metal Walls are available in the three exterior patterns . . . the "Fluted" or "Ribbed" wall can be field constructed up to sixty feet in height without a horizontal joint—a feature of Mahon Walls which, from an appearance standpoint, is extremely important in powerhouses, auditoriums or other types of buildings where high expanses of unbroken wall surface are common. See Sweet's for complete information including specifications, or write for Mahon Catalog W-56.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

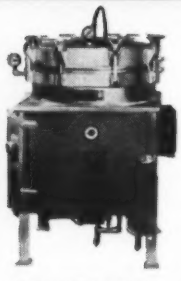
Sales Engineering Offices in New York and Chicago • Representatives in Principal Cities

Manufacturers of Insulated Metal Walls and Wall Panels; M-Floors (Electrified Cel-Beam Floor Systems); Steel Deck for Roofs, Partitions and Floor Forms; Rolling Steel Doors, Grilles and Underwriters' Labeled Automatic Rolling Steel Fire Doors and Fire Shutters.



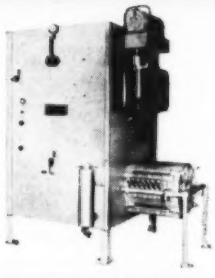
MAHON

HILCO LUBRICATING and INDUSTRIAL
Oil Maintenance Equipment
Saves Your Oil, Money and Machinery



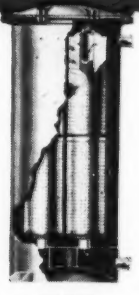
OIL RECLAIMER

For continuous oil purification in range of 2-100 gph. Removes all solids, acids and volatile contaminants.



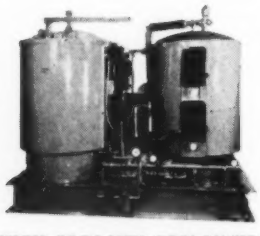
PURIFIER-RE-REFINER

For all purification in batches of from 6 to 100 gallons. Removes all solids, acids and volatile contaminants.



FILTER

Furnished in capacities from 0.1 to 750 gpm. Various cartridges available for mineral and inhibited detergent oils.



HIGH CAPACITY RECLAIMER

Combines filtration for removal of solids and sludge with vacuum vaporization for removal of solids, acids, water, solvents, fuel dilution. Furnished in standard or custom built models to 600 gph.

HILCO purification means *complete* oil purification . . .

Whenever oil is used it becomes contaminated and must be discarded or conditioned for further use. There is a HILCO to do this job for you. You can recover large quantities of oil at low cost. HILCO units are available for continuous or batch operation.

A COMPLETE LINE OF EQUIPMENT FOR RECLAIMING, FILTERING, PURIFYING AND RE-REFINING OIL FROM . . .

- Diesel Engines
- Trucks
- Tractors
- Gasoline Engines
- Gas Engines
- Automobiles
- Buses
- Heat Treating Systems
- Locomotives
- Steam Turbines
- Steam Engines
- Air Compressors
- Vacuum Pumps
- Transformers
- Circuit Breakers
- Wire Drawing Machines
- Hydraulic Equipment
- Metal Rolling Mills
- Paper Making Machinery

THERE'S A HILCO TO DO THIS JOB FOR YOU

• CONSULTING ENGINEERS •

WRITE TODAY! FOR THE NEW HILCO CATALOG FOR COMPLETE INFORMATION AT NO OBLIGATION . . .

THE HILLIARD Corporation

1001 W. FOURTH STREET • ELMIRA, NEW YORK

IN CANADA: Upton-Bradeen-James Ltd., 890 Yonge St., Toronto; 3464 Park Ave., Montreal

damped block must come to rest.

The work you do to keep the thing jiggling, thereby keeping your glow lamp winking, is exactly equal to the electrical energy generated within the coil.

Drat Newton's Third Law.

But congratulations and thanks for a most lucid and informative article on the new ferrites. A magnetic lever it is, the new Leco-latch. But a lever and nothing more. By a long, slow stroke, you pull the ferrite magnet out from between the steel pole pieces, thereby doing the same work you would have to do the hard way if you dragged the keeper off the pole pieces by brute strength. A 4 oz pull, applied for a considerable length of time, equals a 50 lb jerk.

Nope, don't sell your utility or automotive stocks for perpetual motion.

Gene Lindberg
Science Editor
The Denver Post
Denver, Colo.

Sir:

Rather by accident I came across the September 1955 issue of CONSULTING ENGINEER and read the article on permanent magnets.

Starting on page 60 under the caption, Science Fiction?, is the most nonsensical tripe that I have ever read in a magazine which represents itself to be a technical journal. . .

My experiences with consulting engineers is that about half of them are baloney artists. Apparently one of the functions of your magazine is to supply the baloney to the artists.

H. E. Robinson
Senior Research Engineer
Armour Research Foundation
Chicago, Ill.

. . . Or Is It?

Sir:

Having read some of the letters addressed to you in response to your magnet article, the thought occurs to me that anyone using the expression "perpetual motion" in connection therewith ought to read the article again.

I can envision a so-called primitive man, invigorated by a meal of animal and vegetable matter which Nature provided for him, lifting a large wooden log and saying, "This thing has a lot of energy within itself. How can we utilize it?" The wise men — three B. S.'s and one Ph.

WHO

Says Tracing Papers Are All Alike?

See for Yourself the Wonderful Difference in Bruning's Transparentized

No. 357 "KOVEL" TRACING PAPER!

Send for Your Free Trial Sheet Today!

Here's a challenge you'll be glad you accepted. Test the tracing paper you're now using against Bruning's general purpose No. 357 "Kovel" Tracing Paper. You'll discover a wonderful difference that will pay off for you in neater, higher quality drawings and cleaner, sharper, faster prints.

You'll like the greater translucency of "Kovel" brought by an improved transparentizing agent and technique of application. Yet you'll find this vellum-type paper exceptionally strong and durable, able to withstand repeated erasures without losing workability. You'll take pure pleasure in the ease with which the beautiful fine-grained surface takes pencil, also accepts ink, gives you smooth, clean, opaque lines. And its faint blue tint eliminates glare. "Kovel" is great for reproduction, whether used for print making immediately or years later. No leaching, no discoloring, no odor . . . even after long periods of storage.

Send for your free trial sheet today. Discover for yourself the big difference, except in price, that has gained "Kovel" acceptance as the finest general purpose tracing paper of its type on the market.

For all the advantages of "Kovel" in a thinner, untinted white paper, try No. 354 "Frenchvel" Tracing Paper. The high translucency of "Frenchvel" makes it ideal for tracing from weak-lined drawings or blueprints and for higher volume reproduction.

And for a Wonderful Difference in a Smooth Surface Paper, try . . .

BRUNING'S No. 350 "VELLUX"

The moment you put pencil, or ink, to this smooth-surface, vellum-type tracing paper, you'll see what a difference quality can make. This permanently white, transparentized paper is unsurpassed for textural uniformity and for fine all-around performance. Prove the difference to yourself by sending today for your free trial sheet.

BRUNING

America's Largest Supplier of Engineering and Drafting Equipment

CHARLES BRUNING COMPANY, INC., 4700 MONTROSE AVE., CHICAGO 41, ILL.

In Canada: Charles Bruning Company (Canada) Ltd., 105 Church St., Toronto 1, Ont.

Charles Bruning Company, Inc., Dept. 114-K
4700 Montrose Ave., Chicago 41, Illinois

Please send me my 8½ x 11-inch trial sheet of

☐ No. 357 "Kovel" ☐ No. 354 "Frenchvel"
☐ No. 350 "Vellux"

Name _____ Title _____

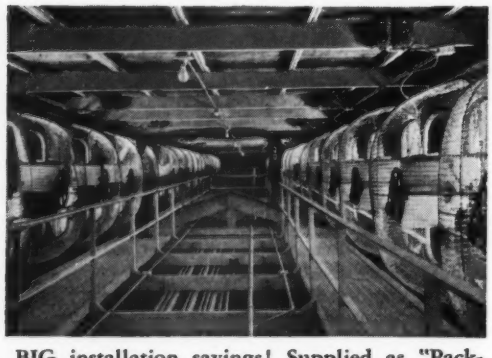
Company _____

Address _____

City _____ Zone _____ State _____

NEED TO VENTILATE AN OFFICE — OR COOL A COLISEUM?

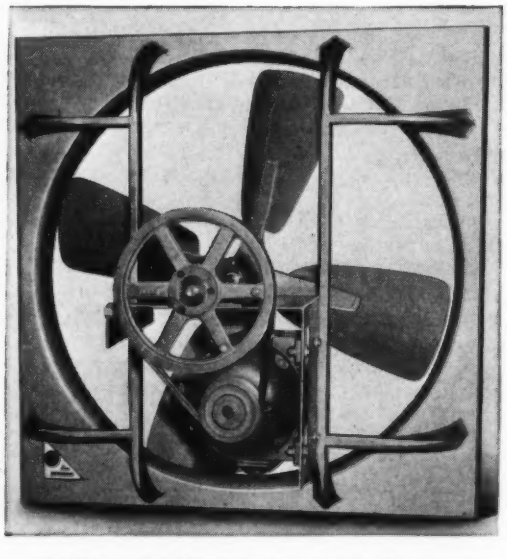
1,439,000 cfm breeze by "Buffalo" Package Propeller Fans ventilates this mammoth new Heart O' Texas Coliseum at Waco, Texas. *Mechanical Contractor: Nuckols-Cathey and Co., Inc., Waco, Texas.*



BIG installation savings! Supplied as "Packages", complete with motor and V-belt drives. Part of 60 Belt-Air Fans in Coliseum.

"BUFFALO" BRINGS PROPELLER FAN ECONOMY TO BIG JOBS!

With this greatly expanded and improved line of "Buffalo" package Propeller Fans, many ventilation jobs once considered too costly or impractical are now being done to satisfaction. First cost and installation savings are significant. Performance, of course, is the big test — amply proved by the fact that the gigantic air moving job at the Coliseum above is done on a total of only *66 horsepower!* "Buffalo" Package Propeller Fans in sizes from 8" to 144" are ready to give you equal satisfaction. Write today for BULLETIN FM-1234 on your company letterhead, and see the wide range of applications. NOTE: no one *type* of fan is the "answer" to *all* types — centrifugal, axial flow and propeller fans — each with the "Buffalo" "Q" Factor* of bonus performance built into it. Bulletins on request.



HUSKY — EFFICIENT! Note sturdy die-stamped construction of this Design 53 Belt-Air Package Fan. Thirty-six 54" and twenty-four 42" Belt-Airs move 1,439,000 cubic feet of air per minute in the Heart O' Texas Coliseum — on 66 h.p.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

BUFFALO FORGE COMPANY

147 Mortimer St. Buffalo, New York

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

INDUSTRIAL EXHAUSTERS BELTED VENT SETS PROPELLER FANS "E" BLOWERS-EXHAUSTERS

D. — laughed, as well they might for fire hadn't been invented then.

Some years later another man found a great many black objects several feet below the ground in his back yard. He said, "I believe this stuff has a lot of smikliks (Btu's) and can be used to light up our houses and villages." The scientists, who already then understood everything, again laughed loud and long. "What are you trying to do — invent perpetual motion?" they said. They died smug, complacent, and happy.

At the same time a man repeatedly tried to cross a swift stream and was knocked down just as repeated ly. He at first thought that there existed a force which could and should be harnessed. A scientist convinced him that if he were to take a log and float it down the stream, it would take as much energy to carry it back to the point of origin. The man gave up and thus lost the opportunity to patent the wheel.

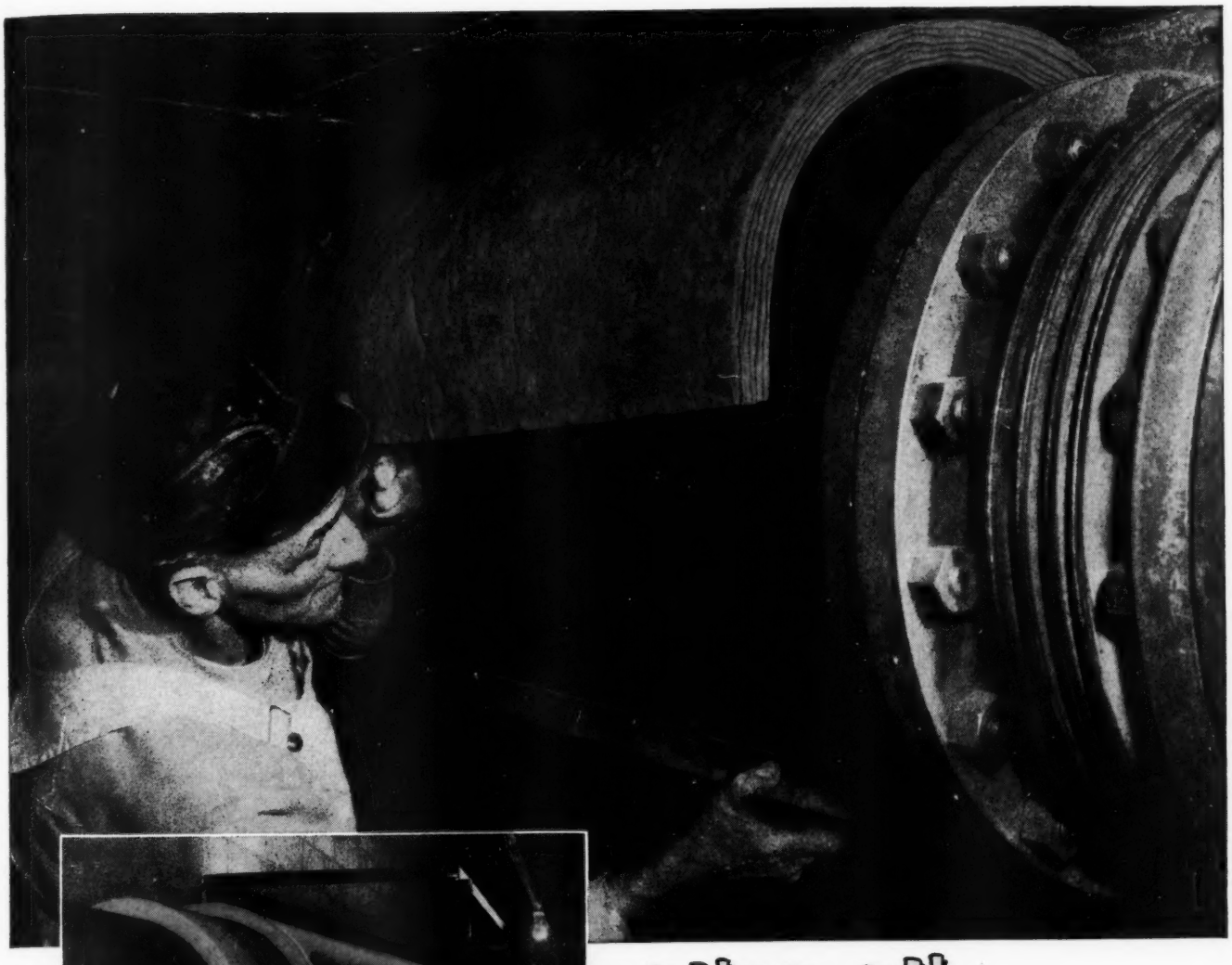
Of course, this sort of thing could not happen now. Did we not establish: that Marconi could not send a

"BUT, TOM, IT CAN'T BE DONE!"

message through space even after he had done so? that a bumblebee should theoretically fall flat on its face? that matter and energy are not the same thing?

As I see it, your article served three purposes: (1) a very interesting review of what makes a magnet, (2) a discussion of the practical applications of a magnet which can be controlled, and (3) an invitation for people to think. The last presupposes the existence of a cerebral cortex. Since some of your correspondents did not furnish proof positive that such a thing exists, would it not be charitable to conclude that they do not possess the same?

Carl E. Schultz
Laboratory Equipment Co.
St. Joseph, Mich.



SNAP*ON...

the modern, efficient way to insulate pipe

Take a good look at the unique one-piece glass fiber pipe insulation that insulates a 6-foot section of pipe as quick as you can say "Snap*On!" Then picture the savings in your plant when you put Snap*On on large or small, hot or chilled piping.

These on-the-job photos were taken at a midwestern university where large steam distribution lines in tunnels were recently insulated with Snap*On. The job was done in remarkably short time because of the exceptional ease of application. Workmen were pleased to discover that Snap*On weighed only 1/10 to 1/4 as much as conventional insulations — yet was so fibrous-tough that there was no breakage . . . no mess . . . no clean-up time.

An important secondary saving was the heat saving. Tests conducted on the finished job by the university showed the surface temperature of Snap*On to be 50° lower than that recorded on the insulation formerly used!

These are documented facts. The same sort of superior thermal efficiency and low-cost application can be yours if you insulate piping up to 33" in diameter, where temperatures do not exceed 350°. But see for yourself — write today for samples and Technical Bulletin SO-55 today.

GUSTIN-BACON *Manufacturing Company*

GUSTIN gb BACON

Thermal and acoustical insulations • Molded glass fiber pipe insulation • Pipe couplings and fittings

212 W. 10th St., Kansas City, Mo.

SCRAPS & SHAVINGS

THE CANONS OF ETHICS FOR ENGINEERS includes a section much disregarded by many consulting engineers. Section 23 says, "He will not directly or indirectly injure the professional reputation, prospects, or practice of another engineer. However, if he feels that an engineer is guilty of unethical, illegal, or unfair practices, he will present the information to the proper authority for action."

It will be noted that this Section includes two rules of behavior that, if taken literally, are not logically compatable. But the intent of the canon is obvious, and operation within its intent should not be too difficult. Medical doctors and lawyers have similar canons in their codes. Perhaps they place too much emphasis on the first of the two thoughts, that of avoiding injury to the professional reputation of a fellow practitioner. They carry this to such an extreme that it is sometimes difficult to take legal action even in obvious criminal cases because of the refusal of other members of the profession to testify for the prosecution.

Engineers, for many years ignored this canon. But now we often hear of action being taken either in the courts, before State Registration Boards, or before professional societies to "bring to justice" incompetent or unethical professional engineers. There is nothing wrong with this, for most of us agree that we need more teeth in our engineering registration laws and better means to prevent the practice of engineering by the technically incompetent and the ethically inept. But that is complying with only half of the canon, and in acting only on this half, the public gets the idea that engineering is a profession made up of haggling fools and picaroons.

Perhaps the more important part of the canon is that forbidding one engineer to injure the reputation of another. Most engineers could place more emphasis on this aspect of Section 23 without running the slightest danger of exaggerating it in the manner of the doctor or the lawyer. In fact, it is essential that consulting engineers, in particular, school themselves to avoid the smirking innuendo, the subtle jab.

We visit the offices of a great many consulting firms and discuss with them such subjects as fees and ethical practices. All too frequently, the consultant first points out the lily-white purity of his own professional ethics, and once his professional virginity is established, he proceeds to a discussion of the fallen state of his fellow engineers.

Part of this is pure egotism. Each consultant has a firm feeling that there could be no other explanation for his losing a project except that "Jones cut his fees." He cannot understand how any prospective client could possibly select a different consultant unless it is on the basis of a reduced fee — or nepotism.

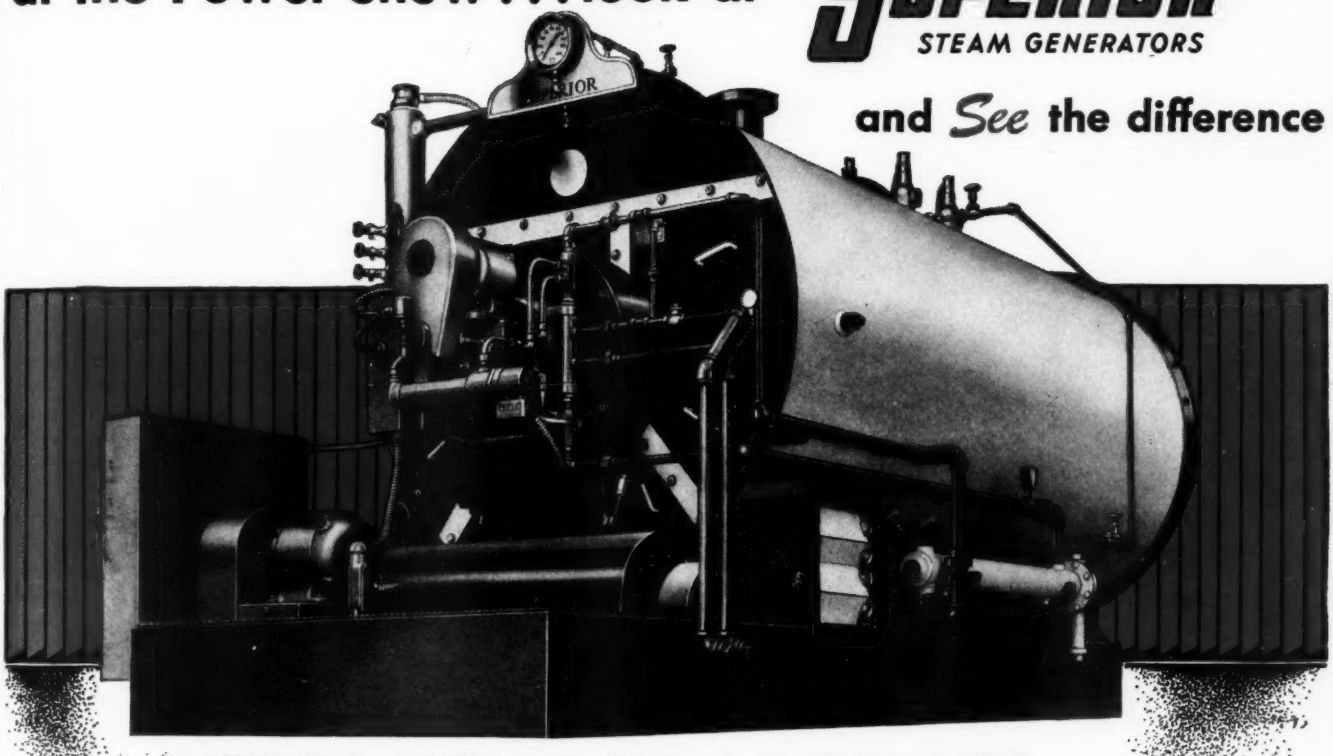
Can you imagine one doctor openly criticizing another doctor, claiming that the only reason he ever gets a patient is because he offers to treat them at a lower fee. We must recognize that other consultants can get business without stooping to unethical activities. It is perfectly possible that the client preferred to deal with another engineering firm for good and sound reasons.

Sometimes one engineer's criticism of another is much more subtle. "John Brown? Sure, I know John. Known him for years. He's done some good work. I think it was wrong that he got all that criticism on the sewage project in Greenville. Probably had a lot of political pressure put on him. Generally speaking, though, he does a pretty fair job. He's registered, all right, — under the grandfather clause. Had some good men on his staff at one time, but most of his work now is with the smaller architects."

That type of talk is so common that one gets the feeling that every other engineer in town is a "has been."

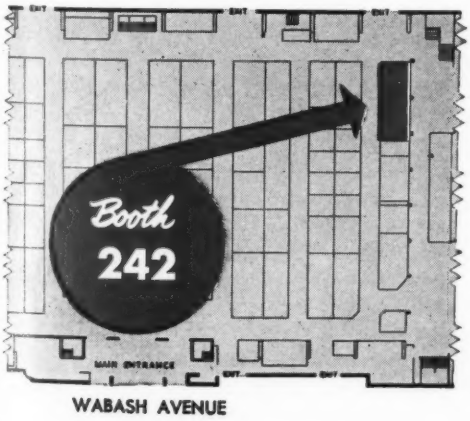
This running down of the competition must be stopped if consulting engineering is to develop as a profession. If there is an obvious instance of criminal incompetence or unethical activity, take it before the courts or the ethical practices committee of an appropriate organization. But injuring the professional reputation of another engineer is also unethical. It is time to quit this sort of talk.

at the Power Show . . . look at SUPERIOR STEAM GENERATORS and *See* the difference



HERE'S WHAT TO LOOK FOR:

POWER SHOW
NOV. 14th through NOV. 18th
1955



WABASH AVENUE

CHICAGO COLISEUM
CHICAGO, ILL.

Look . . . at Superior's 4-pass fire-tube design . . . ample heating surfaces with a minimum of 5 sq. ft. per b.h.p.

Look . . . at Superior's built-in multiple induced-draft fans . . . drawing evenly across the entire tube area, and eliminating the need for an expensive chimney.

Look . . . at Superior's Rotary Burner with its own fan supplying primary air . . . fully automatic with oil or gas, or both . . . change from either fuel to the other quickly, without dismantling equipment or interrupting steam supply.

Look . . . at Superior's safety features . . . induced draft which prevents the escape of combustion gases into the boiler room . . . fool-proof combustion gas pressure-relief port . . . constant gas pilot throughout gas firing periods . . . dual purging of all gas passages, both before and after firing.

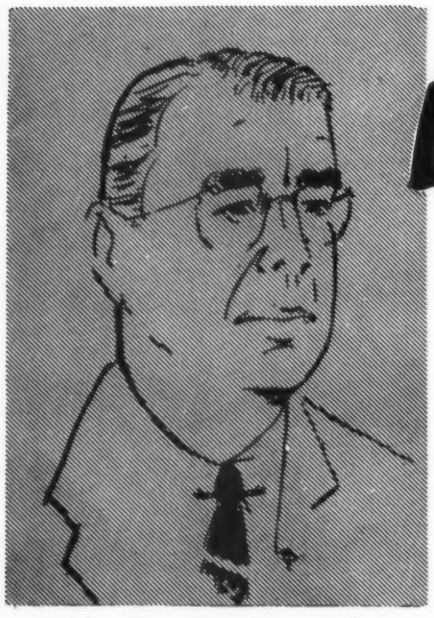
Look . . . at the overall picture . . . a complete packaged steam plant. One purchase shipped completely assembled after factory test to assure dependable operation at a guaranteed thermal efficiency of more than 80%.

Look . . . at Superior's catalog for the complete story. If you're not going to the show, write for Catalog 707.

for performance you can **BANK** *on*

SUPERIOR STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.



Economic News Notes

E. F. Mac Donald
INDUSTRIAL ECONOMIST

SUBCONTRACTING AID — The government requirement for the amount of work a general contractor must do with his own workers on Federal building jobs has been reduced from 25 to 12 percent. This should be a help to small construction firms in getting more work on Federal government projects.

FAST AND SAFE — So claims Ohio for its new $326 million turnpike. Some of the features contributing to speed and safety (and expense of construction) on the 241-mile superway are: (1) the wide—minimum width of 56 ft—center strip which not only reduces possibility of collisions but facilitates drainage by being depressed in its center, (2) use of twin bridges to maintain wide separation of roadway, (3) curves constructed so as to provide a minimum sight distance of 900 ft, (4) frequent gradual curves to prevent monotony—the longest straight tangent is 5.7 miles, (5) construction of shoulders on both sides of each roadway, and (6) reflectorized signs using different colored backgrounds to indicate different information.

OLD DOG — NEW TRICK — 113-year old Thalhimer's Department Store in Richmond, Virginia, has come up with an eye-catching, dollar-saving way of "replacing" an old downtown building. The facade of its city block of buildings of varying heights and different architectural styles was clothed with a jacket of vertically fluted aluminum panels that transformed the old potpourri into a block-long, six-story modern building. The installed cost of the extruded aluminum was about $3.50 per sq ft.

SOLAR ENERGY — Harnessing the sun's energy and commercial conversion to electric power may be realized by 1975, according to Prof. G. G. Brown, dean of University of Michigan engineering college. Predicting the advent of the practical use of solar energy well before any serious shortage of oil and gas, Dean Brown told a dedication audience at the Owens-Illinois technical center that a number of large solar furnaces have already produced temperatures exceeding 7000 F. An opportune practical example of solar energy was furnished a few days later when Bell Telephone engineers switched solar power into the rural telephone system of Americus, Georgia.

STARTING SALARIES — Beginning salaries for Illinois Institute of Technology 1955 engineering grads was $382, up about 4 percent from the 1954 average. Mr. E. C. Kubicek, Institute director of placement service reports electrical engineers heading the payrolls with $416, followed by metallurgical engineering grads with $404.

FIRE HAZARDS — This is an era of new records — some of which aren't desirable. The 313 industrial and commercial fires with large losses ($250,000 and over) last year was a record we can hope will not be repeated. However, Chief Engineer J. A. Neale of the National Board of Fire Underwriters warns that industrial progress is creating hazards materializing in heavy fire losses. He contends that many of these risks can be eliminated on the drawing board before the plant is constructed. Industrial fire danger areas that he referred to include: (1) construction of huge plants without inner fire walls or windows, (2) location of new plants in rural areas with inadequate fire-fighting facilities, (3) high-speed production processes involving inflammable materials and inadequate precautions, and (4) lack of 100 percent sprinkler protection.

TUNNEL NEWS — At the same time that bids were being called last month for completion work on the Hampton Roads bridge-tunnel, announcement was made that DeLeuw, Cather & Co. had been retained to make a traffic study for consideration of a third tunnel — the second under the Elizabeth River from Norfolk to Portsmouth.

THROUGH THE TRANSIT — The Southern Pine Association states that in the past year glued laminated southern pine lumber was used on over 1100 major construction projects in at least 159 cities. . . . It has been estimated that the volume of construction, adjusted for price changes, has doubled in the postwar period and that the volume put in place per employee has increased 34 percent . . . . "It is an alarming fact that the number of first-class engineering students interested in going into the utility business is declining almost as fast as the industry is expanding," Mr. H. Branch, pres. of Edison Electric Institute and head of Georgia Power . . . . An architectural group at Princeton has recently completed a study on the use of stainless steel for curtain walls . . . . Illinois will probably have to borrow over $1.2 billion for toll road construction in a very few years, predicts Gov. Stratton . . . . The Southern New Jersey Development Council has drawn a map locating 446 industrial sites available in a 3000 sq mi area . . . . Mr. H. H. Armsby of the U.S. Office of Education estimates a total of 27,800 engineering grads in 1955-56, up from 22,200 in 1953-54 . . . . Western Electric has announced a program for the substitution of aluminum for copper in its manufacture of telephone cable . . . . Prolonged and serious economic depressions can be avoided and might never occur again, the U.S. Chamber of Commerce holds, but minor ups and downs cannot be eliminated.

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

Preferred for Precision and Performance

FIG. 19084—900-Pound Steel Pressure Seal Non-Return Globe Valve, Gear Operated.

Powell Valves are the choice of engineers because they know every valve is precision made, meeting every specification—every time.

And there are other good reasons why engineers prefer Powell Valves—because Powell Valves are dependable . . . economical . . . and Powell has the COMPLETE quality line of valves.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have.

The Wm. Powell Company
Cincinnati 22, Ohio . . . 109th year

Visit our booth No. 191 at the Chicago Exposition of Power and Mechanical Engineering November 14-18

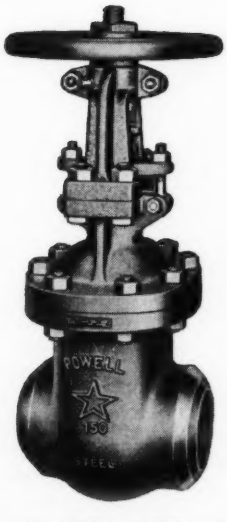


FIG. 1503WE—150-Pound Steel Gate Valve.

FIG. 11323—1500-Pound Motor Operated Steel Pressure Seal Gate Valve.

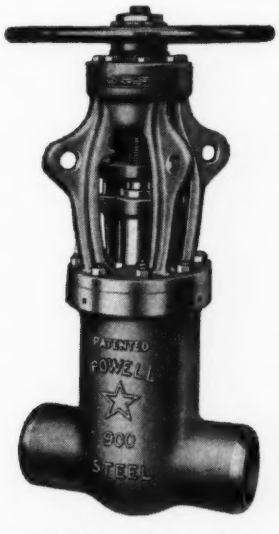


FIG. 19003—900-Pound Steel Pressure Seal Gate Valve.

POWELL VALVES

ATOMS IN ACTION

THE ATOMIC ENERGY COMMISSION, in the second round of its power demonstration reactor program, is inviting proposals by February 1, 1956 for development, design, construction, and operation in the U. S. or its territories and possessions of small-scale nuclear power plants in three power ranges: 5000 to 10,000, 10,000 to 20,000, and 20,000 to 40,000 kw. Acceptance will hinge on cost to AEC in funds, materials, and services; on probable contribution toward achieving economically competitive power, on technical and financial competence of the bidder, and on degree of enrichment of fuel required. (AEC would like to keep this below 10 percent.)

U. S. INDUSTRIAL FIRMS can now talk in unclassified terms to potential foreign buyers of power reactors and equipment in advance of the negotiation of a bilateral agreement with the country involved. This is a result of authorization by AEC, on September 30, for U. S. firms to engage in unclassified atomic energy activity in all nations of the world not Communist controlled. The need, under Section 57(3) of the 1954 Act, to obtain individual authorization in advance was thought to be having a discouraging effect on American industry and potential foreign customers.

ORDERS FOR THREE atomic plants to be installed in Latin America will be placed by American & Foreign Power Co., a subsidiary of Electric Bond & Share Co. Plans call for reactors of 10,000 kw capacity to be built by three different manufacturers, as yet unnamed.

ACCIDENT PRECAUTIONS taken in design of the Army Package Power Reactor were described in detail by Kenneth Kasschau, manager of atomic energy engineering of ALCO Products, Inc., at the Atomic Industrial Forum meeting. The reactor itself is enclosed in a steel vapor container designed to withstand the maximum pressure that could be exerted should an accident occur. The container is lined with two feet of concrete. For air transport, an iron-water shield will be provided if concrete is not available at a remote site.

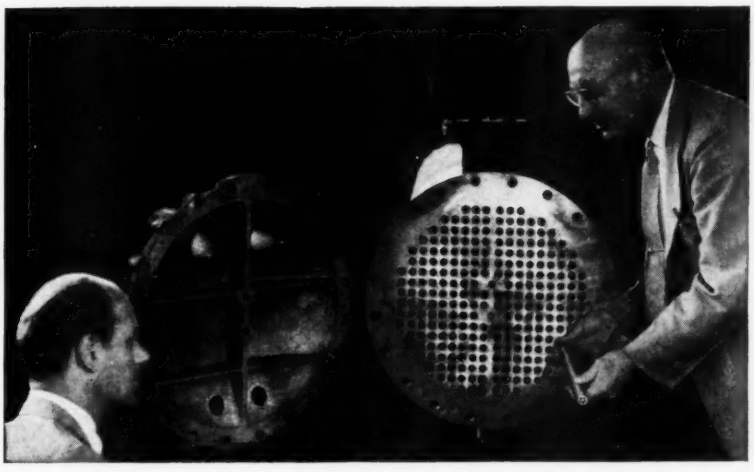
THE NXR REACTOR at Chalk River is back in operation after a seven-week shutdown necessary to repair damage caused by a special fuel rod that was being tested. The rod damaged an aluminum tube in the reactor tank, contaminating the heavy water moderator and sprinkling small chips of plutonium fuel on the bottom of the tank. When ordinary water failed to flush the chips off the bottom, a chemist suggested use of the Christmas table decoration principle in which moth balls are dropped into a bowl of water, baking soda, and vinegar. The gas bubbles adhere to the moth balls and lift them off the bottom. Soda water run through the tank formed bubbles on the fragments and lifted them so that they could be flushed out. Since the repair was made without dismantling the reactor, workmen were restricted to working through a $2\frac{1}{2}$ inch hole at distances up to 28 ft from the damaged part of the reactor.

WESTINGHOUSE Electric Corp. has set up a new atomic power organization to include development, design, and sale of all commercial nuclear reactors. Carroll V. Roseberry, formerly manager of the electric utility and transportation sales department, is manager and Dr. William E. Shoupp, previously assistant manager of the atomic power division, is technical director. In announcing the reorganization, Charles H. Weaver, vice president in charge of atomic power, noted that Westinghouse has built or is to build eight major atomic reactors.

PROJECT SHERWOOD, the Atomic Energy Commission's fusion-for-peace project, making use of the hydrogen reaction, was brought out in the open at a press conference in Washington, October 3, as promised by AEC chairman Lewis L. Strauss at the Geneva conference. The amount of money being spent on the project is currently "classified"—but "quite a significant amount of money," according to Strauss. In existence since 1951, the project is not expected to pay off for about 20 years. He did not discuss specific projects being worked on but listed persons and places related to the project. Central responsibility within AEC lies with the Division of Research, headed by Dr. Thomas H. Johnson, and with a Sherwood Branch within the Division, headed by Dr. Amasa Bishop. Guidance and coordination are by the AEC Steering Committee on Controlled Thermonuclear Reactions, under chairmanship of Dr. Edward Teller. The program is made up of small groups of men working, possibly on competitive approaches to the problem, at a number of laboratories.

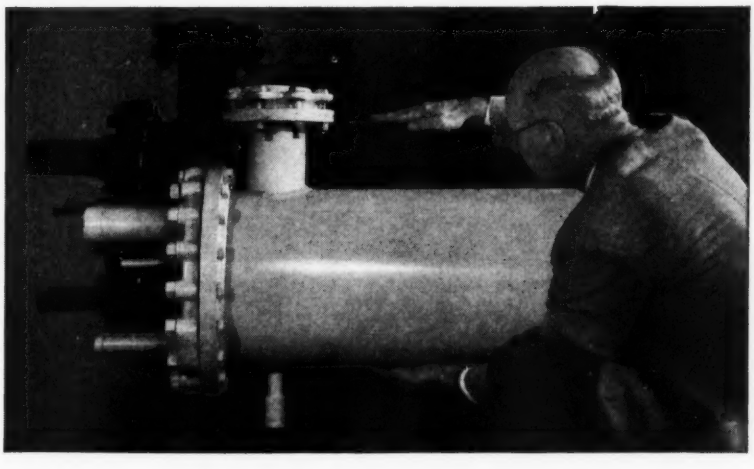
PRELIMINARY STUDIES by the National Board of Fire Underwriters indicate that the danger involved in the operation of atomic power plants by industry, although more serious than any other industrial process, is remote because of rapid progress made in engineering and safety. Research and commercial reactors are now insurable at commercial rates and can be considered in the category of the more hazardous types of chemical operations. Studies are continuing on "third party liability," "business interruption," and "use and occupancy" insurance. William M. Cousins, Jr., assistant director of Armour Research Foundation, suggested at the Atomic Industrial Forum's annual meeting that a plan similar to the workmen's compensation act be drawn up to cover public liabilities in nuclear reactor operation, providing for fixed damage payments to the public and a fixed limit of liability for companies.

Acme DRY-EX® LIQUID CHILLER



PROVEN THRU-TUBE EFFICIENCY MAINTAINED

Acme's star-shaped aluminum insert tubes of the new Dry-Ex extend straight through to multi-pass heads at each end. No bends, no soldered joints — no leaks! High refrigerant velocity is maintained and controlled to achieve greater chiller efficiency, lower pressure drop and more positive oil return than is possible with any other construction.



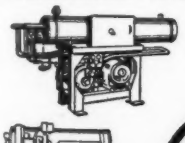
CHILLER SIZE AND WEIGHT REDUCED SIGNIFICANTLY

Diagram shows typical reduction in chiller diameter made possible by the greater heat-transfer capacity of Acme's new Dry-Ex. Because of their smaller size, these chillers fit into closer spaces, are easier for the contractor to handle and install. Reduced weight saves freight costs and smaller cubic content of refrigerant and water means a smaller refrigerant charge, less load on floors and mounting structures.

NEW DRY-EX CATALOG is packed with useful information, contains new selection procedures to simplify your engineering.

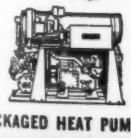
SEND COUPON BELOW TODAY

DRY-EX LIQUID CHILLERS · LIQUID RECEIVERS · HEAT EXCHANGERS · CONDENSERS



PACKAGED CHILLERS

EVAPORATIVE CONDENSERS AND COOLING TOWERS



PACKAGED HEAT PUMPS

ACME
AIR CONDITIONING
REFRIGERATION

CONVECTORS

ACME INDUSTRIES, INC.
Jackson, Michigan

Send me the complete new catalog on Flow-Therm packaged liquid chillers.

Name..... Title.....

Address.....

City..... Zone.....

State.....

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

the Legal Aspect

MELVIN NORD
Consultant in Legal and Technical Problems
Registered Professional Engineer
Patent Attorney

. . . Labor Law in Perspective

IN THE PREVIOUS columns in this series, we showed that labor law as we know it today is a relatively recent development. We found that judges were faced with the necessity of deciding cases without having the aid of any relevant common law rules, and that it has become apparent that labor law can develop satisfactorily only by the enactment of suitable objective legislation. However, we have found that legislation thus far enacted has been as subjective as the court decisions.

There seem to be two reasons for this remarkable lack of objectivity in the development of labor law. The first reason is the obvious one — namely, that the nature of labor law underlies the entire economy, and, in fact, operates directly on the pocketbook of every one, including the members of the courts and legislatures. It is in the inherent nature of the subject that one tends to identify the common good in this field with what will be good for one's self — in other words to act subjectively even when one professes and attempts to be objective. This explains not only why objectivity is difficult to achieve, but also why it is not readily received either. As a result, labor law has developed into a primitive battle of wits and power.

Difference Among Nations

In fact, if one seeks to name the single greatest force tending toward uninhibited general world warfare and the probable extermination of the human race, one finds that it is the difference among nations as to their conception of what labor law should be like. The difference in its maximum form can be expressed thus: on the one hand there is the view that men should be free to seek their individual economic gain with as little limitation as possible, including the utmost freedom in the utilization of natural and human resources (which is the essential basis of individualism and capitalism). On the other hand, there is the view that governments should have the utmost freedom to expropriate natural and human resources for the purpose of achieving maximum economic satisfaction for the public as a whole (which is the professed basis of collectivism and communism).

This, however, is not a complete explanation of the lack of objectivity and the difficulties in labor law. We do not excuse every conceivable kind of action merely because the perpetrator is acting in his own economic self-interest. We do not condone murder or robbery on these grounds. (Even the Communists do not permit private persons to steal or murder in their own economic self-interest.) A philosophy such as this is properly labeled anarchy, and to the extent that we, by implication, approve such excuses, we make it possible for our society to decompose into anarchy, instead of composing it into a system of law and order.

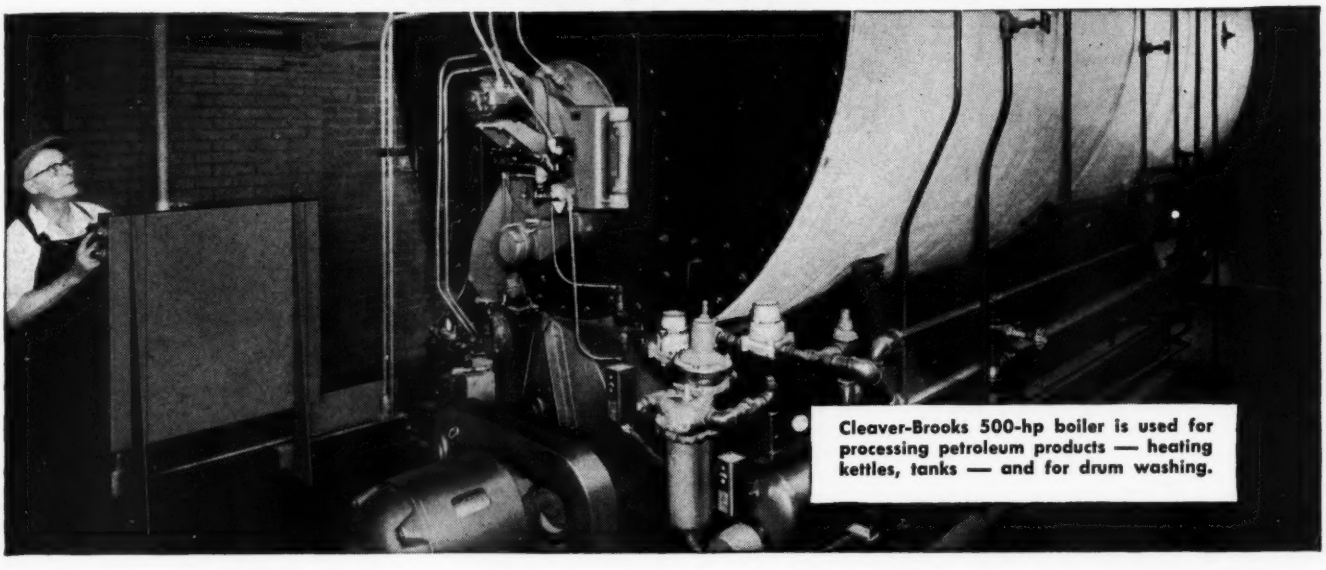
Lack of Perspective

The lack of objectivity in labor law cannot be explained solely on the grounds of subjective self-interest. We have objective rules regulating other aspects of economic self-interest, i.e prohibiting robbery and murder, because we have a two thousand year perspective demonstrating that such activities are socially harmful. The reason we have not developed similar objective rules for governing labor relations is because we do not have much perspective in this field. The lack of perspective in this area cripples any effort to achieve a decent, workable, orderly arrangement in which social justice and not muscle decides issues.

One cannot understand labor relations solely by looking at it as it is today. That is like looking at the side of an elephant and proclaiming it to be a wall, like looking at the elephant's tail and proclaiming it to be a rope, like looking at the elephant's trunk and proclaiming it to be a tree. The truth of the matter is that there "ain't no such

"We heard Cleaver-Brooks Boilers were OK"

. . . and what an understatement that proved to be for a Milwaukee petroleum marketer*



Cleaver-Brooks 500-hp boiler is used for processing petroleum products — heating kettles, tanks — and for drum washing.

Look at the record:

350 gallons of fuel oil saved per day!

On an annual basis — that's more than 90,000 gallons of oil saved.

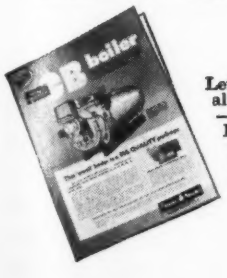
Complete shutdown flexibility with the assurance of fast steaming from a cold start is the key to these remarkable savings for a petroleum processor and marketer in Milwaukee, Wisconsin. Now, a Cleaver-Brooks 500-hp boiler operates 10 hours a day, 5 days a week, where formerly two 150-hp units operated continuously 24 hours a day, 7 days a week. Fewer boiler working hours also saves up to $11,000 yearly in maintenance.

By replacing outmoded equipment, this petroleum processor also enjoys the benefits of guaranteed 80% operating efficiency, four-pass design, forced draft, 5 sq. ft. of heating surface per boiler-hp and fully-automatic firing. Cleaver-Brooks Company, Dept. M, 321 E. Keefe Ave., Milwaukee 12, Wisconsin — Cable Address: CLEBRO — Milwaukee — all codes.

**Name supplied upon request.*

Look at these "before-and-after" facts

	NEW (1) 500-hp Cleaver-Brooks boiler	OLD (2) 150-hp obsolete boilers
FUEL CONSUMPTION	450 gal. per day (10-hr. day) 46 gal. per hour (operating hour)	800 gal. per day (24-hr. day) 60 gal. per hour (operating hour)
SCHEDULED STEAM SERVICE	Automatic firing from 6:30 a.m. to 4:30 p.m. Fast steaming from a cold start.	Continuous 24-hr. operation. Couldn't shut down. Wasted heat. No benefit from extra hours of operation.
OVERALL EFFICIENCY	Average 125 lb. of steam per gal. of oil.	Average 96 lb. of steam per gal. of oil.
OVERALL MAINTENANCE	Cleaned every 6 months. Single maintenance foreman.	Cleaned every 6 weeks. Required extra fireman for weekends.

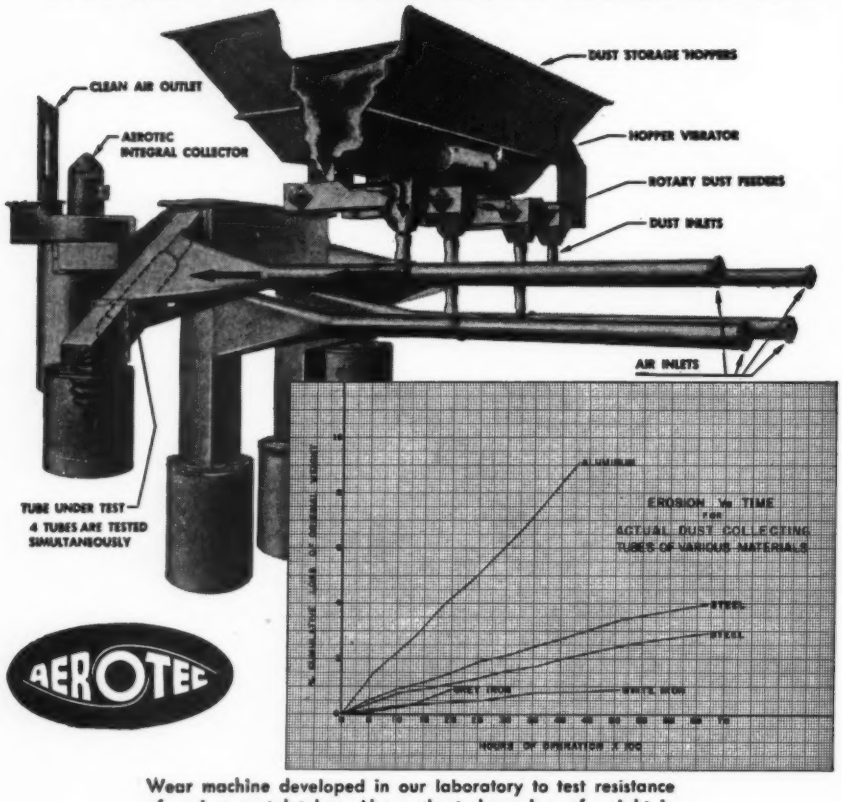


Let us help you beat the penalties of boiler obsolescence — with a modern Cleaver-Brooks installation. Sizes from 15 to 600 hp, 15 to 250 psi — steam or hot water, for heating or processing. Write for catalog.

Cleaver Brooks 25th YEAR

TWENTY-FIVE YEARS OF LEADERSHIP BY THE ORIGINATORS OF THE SELF-CONTAINED BOILER

...PROVING EROSION RESISTANCE



AEROTEC

Wear machine developed in our laboratory to test resistance of various metal tubes. Above chart shows loss of weight in tubes of aluminum, steel, grey iron and white iron.

years of research by AEROTEC now assure *longer tube life* for mechanical dust collectors

Dust collector tubes of aluminum, because of the ductility of the metal, were at one time thought to be more erosion resistant than steel. However, *accelerated tests now prove conclusively that of all the basic metals tested, white cast iron tubes assure greatest resistance to abrasion.*

In setting up the test procedure, unusually severe abrasive conditions were simulated—many times more severe than ever encountered in field installations. The most troublesome dust erosion-wise was selected for the test. After 6700 hours of continuous operation, tube wear for various metals produced the curves shown on this page. Note the outstanding performance of the white iron tube. Although in many cases aluminum tubes are proving entirely satisfactory, white iron is now recommended for the majority of new installations.

In development for over three years, the new Aerotec 5" white iron tube will assure longer life and continuing high efficiency in your dust collection equipment. Why not call or write today for complete information? Address The Thermix Corporation, Project Engineers for Aerotec.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.
(Offices in 38 principal cities)
Canadian Affiliates: T. C. CHOWN, LTD., 1440 S. Catherine St. W., Montreal, Que.

Manufacturers
THE AEROTEC CORPORATION
Greenwich, Conn.

Designers and Manufacturers of Automatic Controls, Valves — Regulating, Relief, and Check Type; Pressure Switches; Gauge, Altitude, Differential and Absolute Types — Float Switches: Top, bottom or side mounted — Single, Dual or Tandem.

animal." In engineering language, it is like looking at the properties of a pure substance at high temperature and low pressure and stating that all pure substances under all circumstances follow the ideal gas law. What about deviations at high pressures and low temperatures? One cannot understand anything unless one can take at least a general view of the whole animal whether it is a zoological problem, a scientific or engineering problem, or the problem of labor law.

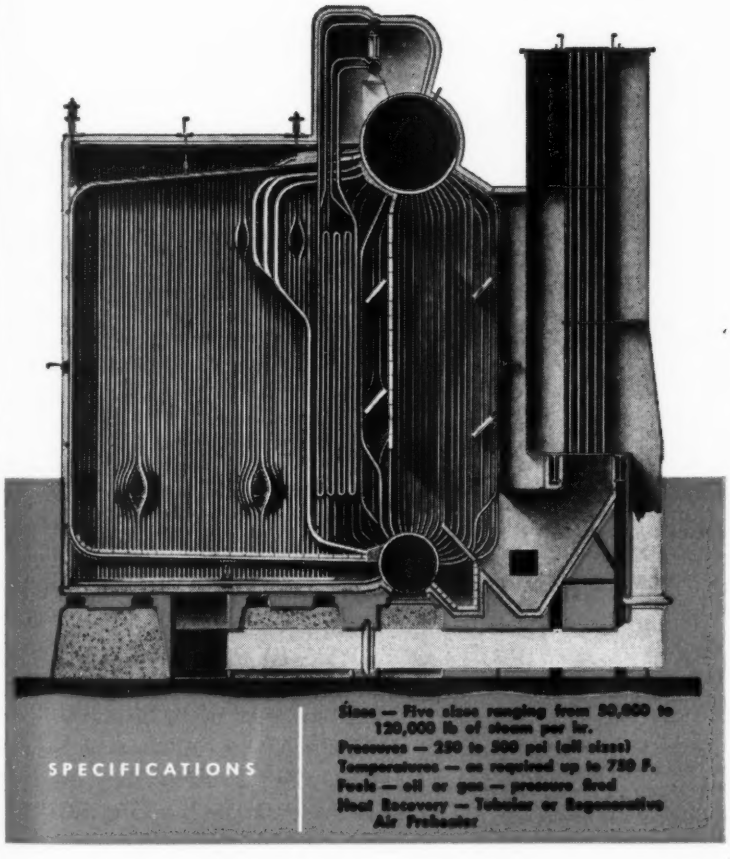
State of Flux

In labor law, the whole picture includes, at the very least, an appreciation of the fact that labor law is in a state of flux. What we see when we look at labor law today is only one frame of a motion picture film. If we mistake this for the whole movie, we are likely to think in an extremely illogical manner. And then, when we see the next frame, we are likely to believe in a very different but equally illogical manner. And that is exactly how we have been acting in the field of labor law. Two prerequisites exist before we can provide satisfactory solutions to our problems in labor law: (1) the objective approach, with a conscious effort to avoid confusing individual economic self-interest with objectivity, and (2) the gaining of a perspective of labor law, not merely as it is in one place, under one set of circumstances, at one time, but of the problem as a whole.

If one were to go back far enough into antiquity, presumably he would find that the first system of division of labor was based on the family unit. One step removed from this, however, is the beginning of an organized form of labor subdivision in society as a whole, i.e. slavery. The master-slave relationship was the original form of labor law. It was quite definite and certain in nature. Although it may have been suitable for its time, it has gradually (over a two thousand year

These performance-proved features make Combustion's NEW VU-55

today's outstanding boiler buy for capacities from 50,000 to 120,000 lb of steam per hour!


SPECIFICATIONS
Sizes — Five sizes ranging from 50,000 to 120,000 lb of steam per hr.
Pressures — 250 to 500 psi (all sizes)
Temperatures — as required up to 750 F.
Fuels — oil or gas — pressure fired
Heat Recovery — Tubular or Regenerative Air Preheater

The VU-55 — a development of Combustion's basic *V*ertical *U*nit design — offers features never before available in a boiler of its capacity range. If your steam needs call for a unit in the 50,000 to 120,000-lb class, you will find it worth while to consider the economic and operating advantages assured by these VU-55 features:

TANGENTIAL FIRING. More than 20 years of application experience have established the exceptional advantages of tangential firing, illustrated and briefly described below. About 90 percent of Combustion's large utility installations use this advanced method of firing.

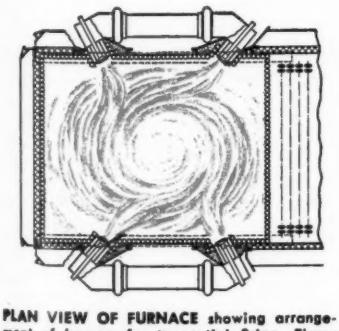
DOUBLE WALL, PRESSURIZED CASING. The latest development in casing construction for pressure firing of boilers in the size class of the VU-55, this casing, as illustrated and described below, is designed to assure lifetime tightness with minimum heat loss. Pressure firing permits the elimination of an induced draft fan with its attendant operating and maintenance costs.

TANGENT FURNACE TUBES. The VU-55's furnace tube arrangement provides complete heat-absorbing, water-cooled protection on all furnace walls. Furnace maintenance is minimized, refractory expense is eliminated, heat absorption rates per sq ft are higher.

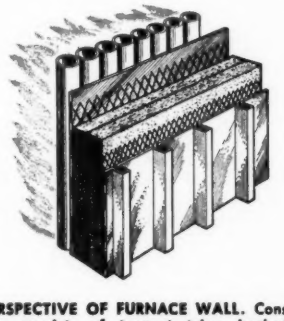
HIGH STEAM QUALITY. Equipped with a large (60-in.) steam drum, the VU-55 has generous water capacity and steam reservoir space. C-E drum internals assure high quality steam at all ratings.

STREAMLINED EXTERIOR. The overall appearance of the VU-55 reflects the efforts of its designers to achieve a completely unobstructed casing, while retaining adequate access wherever required and every facility for convenient operation. There are no outside downcomer tubes, and ducts from air heater to burners are beneath the furnace floor.

Your request for further information on the VU-55 Boiler will receive prompt attention



PLAN VIEW OF FURNACE showing arrangement of burners for tangential firing. Flame streams from the four burners impinge upon one another at high velocity, creating a turbulence unattainable by any other method of firing. The result is rapid and complete combustion. As the gases spiral upward, they sweep all furnace heating surfaces, assuring a high rate of heat absorption.



PERSPECTIVE OF FURNACE WALL. Construction consists of tangent tubes backed up successively by welded steel panels, 4 inches of high quality insulating material and an outer steel casing formed as shown to provide adequately for expansion and assure ample strength. Low heat loss and the tightness required for pressure firing are assured by this welded, double-wall construction.

COMBUSTION ENGINEERING

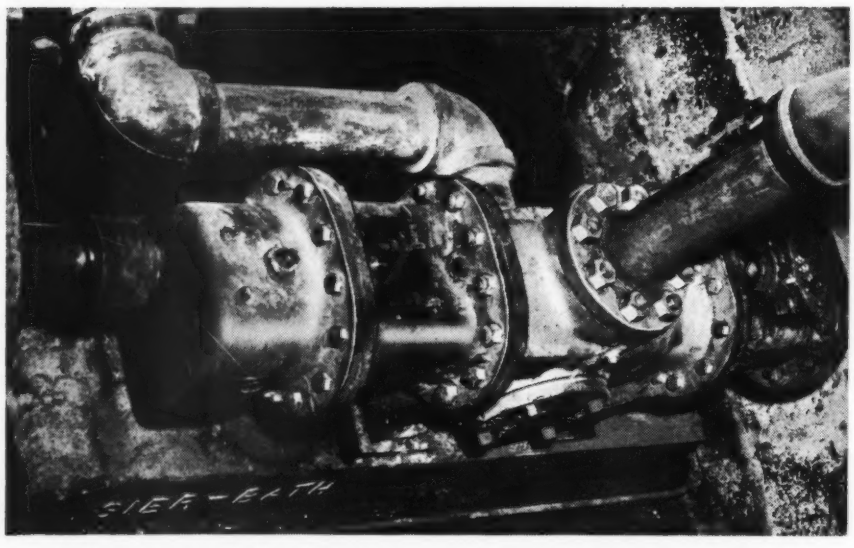
Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.
CANADA: COMBUSTION ENGINEERING-SUPEPHEATER LTD.

B870A

STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; DOMESTIC WATER HEATERS; SOIL PIPE

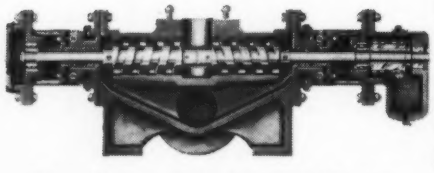
Sier-Bath SCREW PUMP

handling rubber adhesive with VISCOSITY OF 1,500,000 SSU!

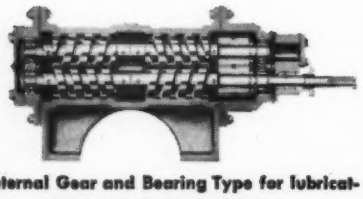


● This installation at Technical Tape Corp., Bronx, N. Y., demonstrates the extreme range and heavy duty service of Sier-Bath Screw Pumps. The pump discharges 2 gpm. against 100 psi and has operated satisfactorily for over 4 years. Pump is an external gear and bearing bracket type, coupled to 5 hp., 90 rpm. motor.

Sier-Bath SCREW PUMPS



External Gear and Bearing Bracket Type for non-lubricating liquids and semi-liquids



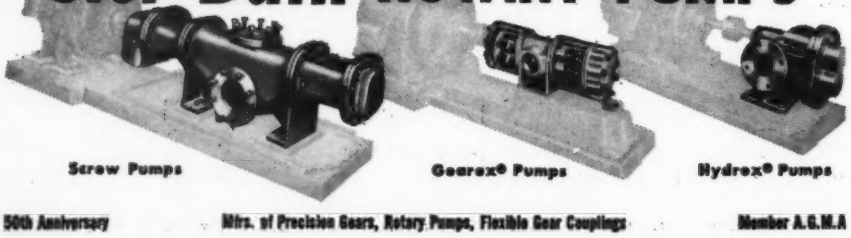
Internal Gear and Bearing Type for lubricating liquids and semi-liquids

Sier-Bath Screw Pumps maintain high volumetric efficiency because "Dual-Controlled" precision rotor design prevents rotor-to-rotor or rotor-to-casing contact—provides a continuous flow without pulsation, hammering or vibration . . . without strains, misalignment and wear on rotors, shafts, bearings and gears.

Result: Dependable, uninterrupted pumping service—less downtime—less maintenance—easier servicing—longer pump life—lower overall pumping costs.

Capacities from 1 to 1,000 gpm.; viscosities from 32 SSU to 1,000,000 SSU.; discharge to 1,000 psi. for viscous liquids, 200 psi. for water and light oils. Horizontal or vertical construction. Corrosion resistant alloys, special bodies, stuffing boxes and bearings for special needs. Call your Sier-Bath representative or write Sier-Bath Gear & Pump Co., Inc., 9257 Hudson Blvd., North Bergen, N. J.

Sier-Bath ROTARY PUMPS



Screw Pumps | Gearox® Pumps | Hydrox® Pumps

50th Anniversary | Mfrs. of Precision Gears, Rotary Pumps, Flexible Gear Couplings | Member A.G.M.A

period) been terminated.

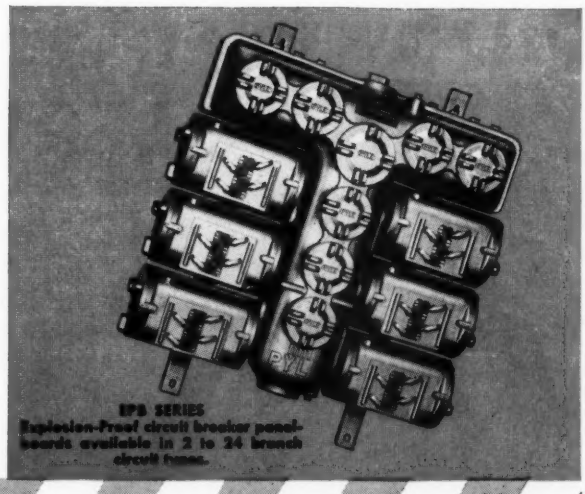
The successor to the master-slave relationship in industrial society is the master-servant relationship. (In agricultural society the servant is called a serf, a peasant, or a peon, depending on the time and place.) It should be noted that one definition of the word "servant" is "a slave or bondsman." In fact, the bondsman, or indentured servant, is basically the connecting link between a slave and a servant, i.e. a "temporary slave." The master-servant relationship is one that is quite definitely regulated in all legal systems, including our own.

Another form of subdivision of labor that has developed in industrial societies is based on an entirely different concept — the concept of an independent contractor. This differs from the master-servant relationship in an extremely vital manner. The master-servant relationship is intrinsically one-sided, like the master-slave relationship, both parties acting in behalf of one of the parties. The independent contractor relationship, on the other hand, is a two-sided arrangement, the parties dealing with each other at arm's length, each looking out for his own interests and acting accordingly, within rules of allowable conduct prescribed by law.

What we have at present in organized labor relations is certainly not an independent contractor status in the legal sense of the word, but it seems to be tending in that general direction. Organized labor is apparently in an in-between position, the employees being servants in some respects and independent contractors in others. The more one considers this, the more puzzled one becomes in trying to understand how two apparently opposite and contradictory theories can be applied simultaneously.

Possibly, some permanent method of reconciling the day-and-night differences between one-sided and two-sided transactions really can be worked out. But it

SPECIFY...
PYLETS®



FOR HAZARDOUS LOCATIONS

Second to none for...

SAFETY: Explosion-proof and dust-tight PYLETS *exceed* code requirements and provide maximum protection for personnel and property against fire and explosion.

ECONOMY: PYLETS are designed for quick, easy installation and convenient maintenance. Rugged construction insures a long service life.

- TAPER TAPPED HUBS
- SMOOTH, ROOMY INTERIORS
- QUICK ACTING JOINTS
- DEPENDABLE MECHANISMS
- ALUMINUM ALLOY OR HEAVY CADMIUM PLATED FERROUS ALLOY CASTINGS

SINCE 1897

THE PYLE-NATIONAL COMPANY

WHERE QUALITY IS TRADITIONAL

1337 North Kostner Avenue, Chicago 51, Illinois

District Offices and Representatives in Principal Cities of the United States • Canadian Agent: The Holden Co., Ltd., Montreal
Export Department: International Railway Supply Co., 30 Church St., New York

CIRCUIT CONTROLS • PLUGS AND RECEPTACLES • LIGHTING FIXTURES • FLOODLIGHTS

the NEW

USG SOLFRUNT®

(SOLID FRONT CONSTRUCTION)

the gauge with

BUILT-IN SAFETY!

There's safety with the new USG Solfrunt Gauge . . . behind the face is a solid metal wall! In the event of a Bourdon tube rupture, pressure is released through the large rubber blowout back. The case is of aluminum.

Like USG's Supergauge . . . with proper application . . . the Solfrunt is built to last a lifetime.

ARC-LOC MOVEMENT—Rugged beyond compare . . . broad generated gear faces, deep stainless steel bushings. Calibration adjustments from rear by merely removing blowout back.

SEGMENT—Stainless steel, with nylon-faced gear section. Nylon-to-metal bond stabilizes the nylon against expansion and contraction . . . maintains accurate pitch diameter . . . assures proper mesh with stainless steel pinion under severe temperature and moisture conditions.

LEGEND ON DIAL—gives complete description of socket, Bourdon tube, and movement material for ready identification.

MICROMETER ADJUSTABLE SELF-LOCKING POINTER—permits accurate repositioning of pointer.

Solfrunt Gauges available in 4½", 6" and 8½" sizes. For complete information on case styles, materials of construction and connections, write for Publication 1819.

UNITED STATES GAUGE USG

Gauge Headquarters FOR OVER 50 YEARS

United States Gauge, Division of American Machine & Metals, Inc., 105 Clymer Avenue, Sellersville, Pa.

seems more likely that the present stage of development of labor law is an unsteady state; not a stage that is likely to continue essentially unaltered for any great length of time, but one that will continue to evolve. If this is so, it is not bad in itself and may indeed be very good. We should welcome change when we have a situation that cannot really be regarded as good. But, if this theory is correct, it is vital that we try to find some suitable direction for the changes to go, instead of letting developments run wild in an uncontrolled zig-zag fashion.

Destination

Perhaps the ultimate destination should really be that of full independent contractor status for laborers, if this can be worked out satisfactorily. Perhaps this could be accomplished by the formation of corporations that would be owned by laborers and by supplying labor to producing or operating companies by contract with such "labor corporations." It is difficult to tell whether such an extrapolation into the future can be predicted in advance, or whether it requires experimentation on a small scale. But whatever the solution is to be, we should keep our minds open, and recognize that the evolution of labor law is not some foreign type of "ism," but is basically the evolution of labor relations from the primitive form of slavery, through the dark-age concepts of serfdom and master-servant relationship, and eventually toward a stage in which laborers will have achieved a status commensurate with the dignity of completely individual human beings.

This trend is all to the good if it eventually permits all our people to be individuals; but if men hope to have all the rights of truly free persons, without any of the responsibilities, they will find it is impossible. That is not something that men can do. It is something which only women can do. . . ▲▲

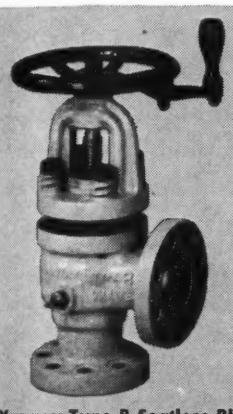
serve every boiler blow-down need

■ Whatever your *pressure* requirement, whatever your *piping* requirement—there's a Yarway Blow-Off Valve to exactly meet your needs.

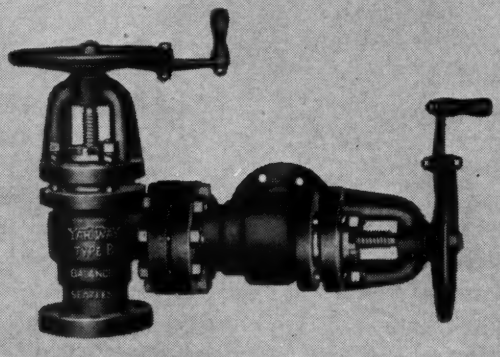
Popular Yarway *seatless* design keeps blow-down lines drop-tight in low and medium pressure ranges. Sturdy Yarway *stellite seat and disc* design protects higher pressures.

All Yarway Blow-Off Valves are strong, rugged valves, built to withstand the punishment of regular or emergency blowing-down under full boiler pressure, and are available in metals that stand up under acid washing of boilers.

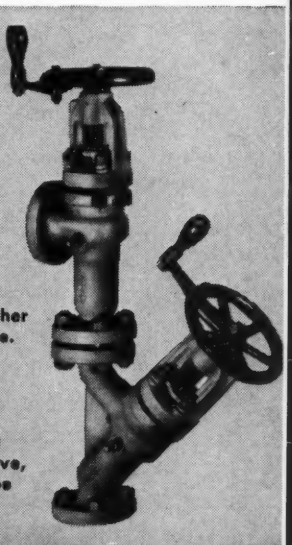
Write for new Yarway Blow-Off Valve Bulletins—B-426 (pressures to 400 psi) or B-434 (pressures to 2500 psi).



• Yarway Type B Seatless Blow-Off Valve, iron body for boiler pressures to 200 psi, steel bodies, for pressures to 400 psi. Angle valve shown, straightway available. Flanged connections. See Bulletin B-426.



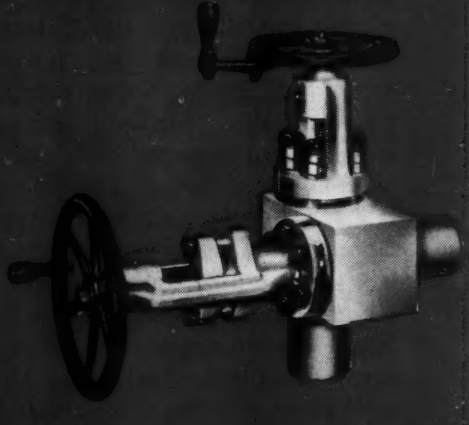
• Yarway Type B Seatless Tandem Blow-Off Valve combining two angle valves. Other combinations available. Iron bodies for boiler pressures to 200 psi, steel bodies for pressures to 400 psi. See Bulletin B-426.



• Yarway Type C Seatless Tandem Blow-Off Valve combining angle and straightway valves. Other combinations available. Flanged or welding connections available. For boiler pressures to 600 psi. NOTE: When used in tandem with a Yarway Hard-Seat Valve, Type C Seatless may be used to 1500 psi. See Bulletin B-434.

• Yarway Hard-Seat Blow-Off Valve for pressures to 2500 psi. Straightway valve shown. Angle available. Welded (shown) or flanged connections. See Bulletin B-434.

• Yarway Hard-Seat—Seatless Bolted Tandem Blow-Off Valve. Hard-Seat is the blowing valve, seatless is the sealing valve. Available in any combination of connections. For pressures to 1500 psi. Hard seat-hard seat tandems for pressures to 2500 psi. See Bulletin B-434.



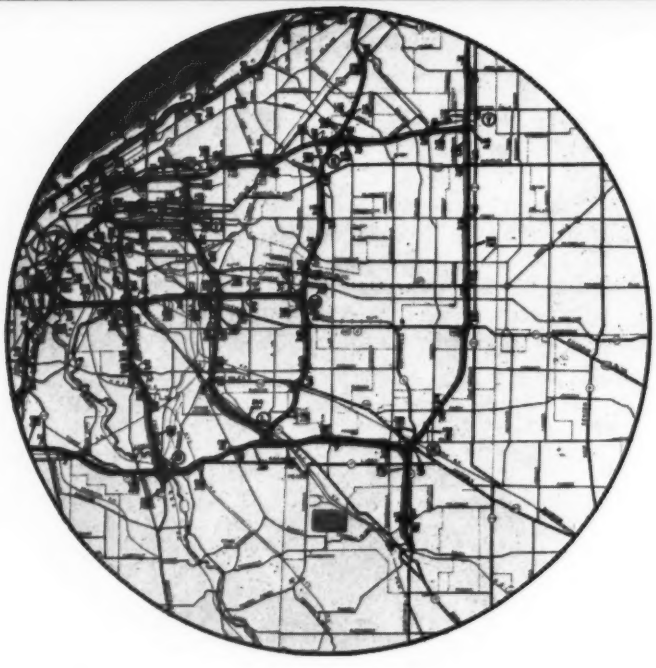
• Yarway Unit Tandem Blow-Off Valve. Combines a hard-seat blowing valve and a seatless sealing valve in one-piece forged steel body for boiler pressures to 1500 psi. For pressures to 2500 psi, two hard-seat valves are combined. See Bulletin B-434.

LET YARWAY HELP SOLVE YOUR BOILER BLOW-DOWN PROBLEMS!

YARNALL-WARING COMPANY
106 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY

blow-off valves



The Engineering Approach to Plant Location Problems

CHARLES P. WOOD, Industrial Engineer,*
Lockwood Greene Engineers, Inc., New York

IN THE EARLIER STAGES of industrial development in the United States, manufacturing plants were generally built near sources of raw materials, at transportation centers, to serve local markets, or to take advantage of local waterpower or local fuel supplies. An era of railroad building opened up large new areas, principally to the West, followed by a corresponding shift and increase of population and the movement of manufacturing facilities to serve the new markets thus created. The western movement was further accelerated by the discovery of gold in California and Colorado. Coal was generally the cheapest fuel, and railroads the most economical transportation, except where waterways were available. This went on for a number of years, even up to the period within the memory of some who are still living. Then came the automobile, which revolutionized transportation and created the demand for more and better highways throughout the country. The discovery of oil and natural gas and the pipelines built to bring in these fuels from remote areas opened up new locations to compete with the coal fields. The pattern of industrial plant location was further broadened by electric power transmission lines built to serve nearly every area where the population became sufficiently dense to provide markets for industry.

Transportation

Since the development of our largest industrial centers, based on then existing railroad freight rates, waterways, and highways, railroad rates have risen, and improved transportation by motor trucks on modern highways often has proved to be more convenient and sometimes more economical than rail movement, especially in the less-than-carload, short-haul field. This condition has forced relocation of plants to conform with modern transportation facilities and the increasing and shifting population. It involves not only new or improved equipment and the combination of rail and motor service but also the construction of new highways and the improvement of old highways to accommodate increased volume of freight and passenger traffic at higher speeds than seemed possible before transportation was expedited by logistics of World War II. Moreover, pipelines for oil and gas have made these fuels available without dependency on railroads, waterways, or highways.

Modernized trucking equipment and improved highways have taken the place of railroad transportation to such an extent that many plants get along without a railroad siding. However, a site with a railroad siding is a better investment than one without a siding because the investment is protected in event of future conversion that might require rail facilities.

The Ohio and Mississippi River-to-Gulf Waterway is a good example of how rail and water transportation have combined to serve two great industrial districts, each of which is benefited by communication with the other. Resources of the Great Lakes and the Ohio River Valley are supplemented by the resources of the Gulf Coast, so that industry in both areas, especially the chemical industry, has grown far beyond what it might have been without this economical means of transportation. Intermediate points at the same time have profited from locations on this main commercial artery.

Recent Growth

We are now much further along in our industrial development than this outline would indicate. Two World Wars have created great demands for de-

---

*Charles P. Wood is a life member of the American Institute of Electrical Engineers and a member of the American Institute of Consulting Engineers.

fense facilities, which are largely available for other production during peacetime. New discoveries have created new products for manufacturing, and now atomic energy is within sight, with its tremendous possibilities not only as a source of power but also as a factor in new processes in various fields, which research has already begun to discover.

The great activity in building industrial plants during the past few years has been necessary in order for industry to catch up with urgent improvements and expansions that have been put off for various reasons or that have become essential because of new discoveries, new products, and new markets have arisen.

Before World War I, there had been major expansions or relocations, such as the beginning of the movement of the textile industry from New England to the Southeast, the westward expansion of the steel industry, and the building of grain mills and food processing plants at strategic points. After the War, however, there was a more noticeable activity in developing new industrial areas, which led to the formation of various agencies to supply the demand for information about the industrial characteristics of these places having potential manufacturing opportunities. The chambers of commerce, railroads, and public utilities organized industrial development departments. Real estate dealers began to specialize in industrial sites. More recently, state development departments have become active. Private agencies also offered their services for analyzing the industrial characteristics of various places. The depression of the '30s put a damper on all these activities.

This period was followed by World War II and the post-war period, during which all previous production records were broken. This great expansion in production accounts for the continued demand for new sites to accommodate new industries or the expansion of existing industries.

Methods of Industrial Development

Competition among communities, railroads, and utilities has led to extensive promotional advertising and offers of free services for industrial prospects who may be seeking new locations. These offers are bona fide, and they can be very useful if kept within reasonable limits. Out of the competition among communities for new industries, several distinctive types of development have emerged. Some of these are designed to meet the requirements of industries that look for financial assistance in purchasing sites and constructing buildings. Familiar illustrations of these developments are:

¶ Offers of inducements by communities, such as free sites, tax exemptions, extension of water lines, sewers, and other utilities.

¶ Offers to finance buildings from local funds, usually on long lease. These funds may be raised by private subscription or by public bond issues, when allowed by state law.

¶ Low rental in existing buildings or buildings put up for industrial occupancy.

¶ Industrial districts with railway sidings, driveways, power lines, water mains, and sewers installed to serve sites of varying size. These industrial districts are generally developed by real estate operators, railroads, or contractors. Sometimes the profit comes from the sale or rental of land and buildings; in other instances from profit on construction; and, for railroads, in protection against competition from other lines.

Another type of operation, usually financed by insurance companies for preferred risks, is designed to take advantage of existing tax laws under which depreciation charges are limited but a larger amount as rental can be charged to running expenses. The plant is built to the lessee's specifications and then leased for a term long enough to insure amortization, after which the lease is renewed at nominal rental.

How to Search for a Location

When a manufacturer ventures forth in quest of a new location and reads the advertisements and hears from all the people who want to help him, he can either get a lot of good assistance for almost nothing or can become bewildered by a mass of useless information. Obviously, the first course is the better. It can be followed by confining the original inquiries to the few essential elements that will affect the final decision. These elements vary for different industries, but they can be isolated for each potential site by a simple analysis.

Breaking down the cost of production and distribution into the most important elements will reveal the percentage of total cost represented by each. Concentrating on the items with the higher percentages will show what is important in searching for a new location. It is generally true that numerous items are too small to have any appreciable effect on location, so why waste any time on them?

In listing the indispensable elements that affect the selection of an industrial location, some, if not all, of the following are generally included:

¶ Cost and quality of labor and availability of the required number of workers

¶ Cost of bringing in materials

¶ Cost of distributing products

¶ Cost of power

¶ Cost of fuel

¶ Quality and quantity of water

¶ Facilities for waste disposal

¶ Availability of suitable sites

A simple procedure is to find first the geographical center of material sources, based, for example, on ton-miles; next find the geographical center of distribution of products; then select a point that combines the most advantages for both material

assembly and product distribution. With this point as a center, neighboring places should be explored with a view to finding the one that combines the essential requirements with other desirable features.

The next step is to inspect sites at the place found so far to be most desirable. It may become necessary to move on to another place because no site at the first place will fulfill requirements.

After working out the fundamental reasons that a certain place promises to be the best location, there are other questions that are less important individually but that may combine to influence the decision. These include the social, religious, and political characteristics of the place, the size and character of existing industries, the local attitude towards industrial activities, recreation facilities, educational institutions, housing facilities, and taxation.

Published tax rates alone will not serve for true comparisons, because some taxes can be negotiated and others are affected by the corporate structure, volume of sales, value of inventory, cost of plant, and other items. The total of all taxes is needed for comparison. This requires setting up theoretical taxes on the same basis as existing levies. Whoever checks the existing tax bill would be best qualified to make the estimate.

Having found the combination of a desirable locality with a suitable site, it is a good idea to obtain options so that further inquiries, such as testing for foundations or drilling for water, can be pursued with more freedom. Usually the manufacturer prefers to withhold his identity until after he obtains options on one or more sites. This relieves him of much inconvenience and even embarrassment resulting from pressure being brought to bear on him from sources interested in having him locate at some particular place.

The Approach

The larger companies can do their own preliminary planning for future plant extensions and new locations through conferences of department heads and executives, followed by appointment of a working committee. This committee usually engages a consulting engineer. The committee's recommendation is reviewed by the executives, who visit the proposed sites and form their own impressions about the town, the site, the people, company policy, business strategy, and whatever else they may have on their minds. In smaller companies, the consultant is generally engaged by the executives and he reports directly to them.

Two diametrically opposite approaches have been observed in the search for industrial locations: ¶ A broad survey of the entire field, subjecting available locations to the same analysis, and selection on the basis of the one that fulfills the requirements to the greatest degree. This is the logical engineering approach and the one that applies to the method recommended here in this discussion. ¶ Starting out with a limited area, one community or even one particular site, and emphasizing the best features in the hope of subordinating conflicting disadvantages. This approach, although entirely one-sided, should not be underestimated, because its advocates include able individuals with important business connections, who know how to exert their influence when and where it counts.

The Part of the Consultant

The promotion agencies that supply answers to questions about industrial locations have access to good advice from engineers and use it freely. It can be seen, however, that there is need for impartial comparison of various advantages that are presented, and here is where the consulting engineer can earn his fee and render additional services in assembling confidential data, inspecting sites, and in various other ways important to the client.

The consulting engineer's viewpoint is necessarily different from that of the promotion agencies. He is looking for the weak points while they are emphasizing the strong points. Between the two of them, they can do a good job without duplication of effort, but the engineer must have sound judgment born of training and experience in order to support his recommendations. There are "experts" and "specialists" who rush in where engineers fear to tread. In so doing, they occasionally strike it right and appear to have found a relatively easy or quick solution to a problem. In this way, they sometimes gain the confidence of industrial executives, while the engineer is not willing to make promises that would compete with them.

The consulting engineer should be qualified to review the claims of competing communities and to compare locations as described in reports by various local agencies as well as by specialized location services. He should reduce them to a common denominator and eliminate extraneous material. Then he can make a recommendation based on his client's most important requirements. Most of the reports that come in from various other sources claim to do just this, but the records show that they are limited either by local interest or by too much theory and too little practical experience.

Consultant Can Discriminate

With further reference to the services of a qualified consulting engineer, he can eliminate many useless questionnaires and consideration of irrelevant items, because his training qualifies him to discriminate and to recognize the most important features of an industrial problem without resorting to complicated statistical methods. It is well to observe here that effective work in comparing the resources of various places and in selecting the best possible sites does require the rare gift of imagina-

SOME MANUFACTURERS HAVE THE IDEA THAT THE WAY TO GET A NEW PLANT SITE — PLUS FINANCIAL ASSISTANCE — IS TO TAKE THE CITY FATHERS FISHING.

tion — in addition to the literal interpretation of the facts made available from various sources.

Some Examples

Extravagant claims and irrational publicity on the part of some communities and promotion agencies are largely responsible for abuses that retard progress in finding the best industrial location. Manufacturers needing financial assistance get the idea that a fishing expedition will produce attractive offers from various communities. They proceed to make inquiries without having any definite plans; hoping, perhaps, to formulate their procedure after they have received proposals of assistance. Again, company officials have not been able to resist the temptation of getting free publicity by looking around and being rated as "prospects" before they have any serious intentions.

Another unfortunate result of heedless publicity is to encourage some of the smaller places that have no important industrial advantages to think they can "get a pay roll" by raising an industrial fund to finance buildings, by developing an industrial district — or just by advertising.

Interesting sidelights on industrial development activities are found in the following quotations from the August issue of CONSULTING ENGINEER, under "Economic News Notes":

"Dixie Diversifies — The sharp expansion in recent years in North Carolina of electrical and electronic industries is spilling over into South Carolina. General Electric is constructing a $6-7 million plant near Columbia for the production of radio and TV capacitors. Industrial plants located in "rurban" areas of the South have paced the new trend in factory design and layout and in industrial decentralization.

"Industrial District — The Flowood Industrial District at Jackson, Miss., is the latest addition to the growing number of planned industrial districts in the nation. Consisting of 300 acres in a rural county within the Jackson Metropolitan Area, the district is served by two railroads, U.S. highways, and with natural gas as well as electric power. Brochure available."

and from the Sunday supplement of the *New York Times,* August 8, 1955:

"Main Street Thirty-five Years Later" [Sauk Centre, Minn., made famous by Sinclair Lewis as "Gopher Prairie"]

"Most of the citizens seem content to leave the town as it is and let it grow with the country. A few years ago a group of citizens put up $40,000 to lure some new industry inside the city limits. No industry took the bait and presently, with what seems to have been a sigh of relief, the man behind the drive gave the money back to the contributors."

Site Development and Zoning

There are numerous other considerations that apply to the selection of places and sites for manufacturing. These include the layout of the plant, location of driveways and railroad sidings for incoming and outgoing traffic, the proper location of the plant on the site, foundations, drainage, landscaping, advertising value, transportation for employees, parking space, space for future extension.(1)

Where a plant has offensive characteristics, such as noxious fumes, smoke, dust, polluted waste or excessive noise, the zoning laws and neighboring occupancy require special study. Not only existing laws, but the trend of legislation and the trend of adjacent development must be taken into account.

—Continued on page 84

(1) "Engineering a Site Study," CONSULTING ENGINEER, February, 1955

PHOTO SHOWS THE INTAKE STRUCTURE, CURVE OF DAM IN BACKGROUND, AND SURGE TANK IN THE DISTANCE AT LEFT.

These Contract Terms Got Action

NORRIS MATTHEWS, Tippetts-Abbett-McCarthy-Stratton
Consulting Engineers, Ankara, Turkey

ON JUNE 22, 1953, ten bids were received by the Ministry of Public Works in Ankara, Turkey, for the construction of a major hydroelectric project on the Seyhan River about eight kilometers north of Adana in southern Turkey. All bids, except one which was withdrawn because of an informality, were publicly opened and recorded. The low bid of Morrison-Knudsen International Co., Inc., combined with Garanti Insaat Ltd., of Istanbul, amounting to approximately 40 million Turkish liras ($14,286,000), was accepted by the Ministry. The contract was executed on July 17, 1953 and registered by the Turkish General Accounting Office on July 23, 1953. Construction started within thirty days of this date, and the contractors must complete the project by June 30, 1956.

Importance of Project

This contract for the construction of the Seyhan Dam and appurtenant works is the largest single contract ever awarded by the Turkish Republic. In addition, the contract represents several conspicuous "firsts" for modern Turkey. It is the first time that an internationally known American contractor has joined forces with one of the largest Turkish contractors for the construction of a major project; it represents the initial use of a special modified form of cost-plus-a-fixed-fee contract in Turkey; and it is the first time that funds for construction of a major project have been provided through the mutual efforts of an international lending agency (the International Bank for Reconstruction and Development), the Turkish Government, and local private capital. To emphasize the importance of the project to Turkey, and to stress the value of international cooperation, the signing of the contract was witnessed by the Prime Minister of Turkey, His Excellency Mr. Adnan Menderes, and the Speaker of the Chamber of Deputies, Mr. Refik Koraltan.

In addition to the main contract for the construction of the Seyhan Dam, there are approximately forty subsidiary contracts involving: construction of access roads and government buildings; purchase of construction equipment; procurement of principal items of mechanical and electrical equipment for the powerhouse; and construction of transmission lines and substations. The total cost of the complete project is estimated to be $34,480,000.

Foreign exchange requirements for the Seyhan

Norris Matthews, a graduate of Columbia University School of Engineering, served four years as an officer in the U. S. Naval Reserve. From 1947 to 1951 he was a specification engineer in the New York office of Tippetts-Abbett-McCarthy-Stratton. Assigned to the Middle East TAMS office in 1951, he presently is continuing his duties as head of the Specifications, Estimating and Equipment Section.

Project are being met by a loan from the International Bank for Reconstruction and Development. Local funds are being provided in part by the Ministry of Public Works and in part by the Cukurova Power Authority. (The Authority is owned by the inhabitants of the region that will be served by the project, and it will operate the power part of the development.) All contracts were prepared to permit international competition, and payment is made in the currency of the nation of the successful bidder. Several contracts for construction equipment have been awarded to British, German, and French firms.

Description of Project

Preliminary engineering studies for the Seyhan Project were made by the International Engineering Co. of San Francisco. Tippetts-Abbett-McCarthy-Stratton, of New York, prepared the detailed design and contract documents in the Ankara offices, and also are assisting in the supervision of construction and acting as consultants on all technical matters confronting the Ministry.

Seyhan Dam will be an earth fill structure about 1800 meters in length with a maximum height of about 57 meters. The dam embankment will be composed of an impervious section of cohesive materials, and upstream and downstream pervious sections of conglomerate. Estimates indicate a total of 10-million cubic meters of material will have to be excavated, of which about 7.5-million cubic meters will be required for the dam embankment.

Storage capacity of the reservoir to be created by the dam will be about 1450-million cubic meters, with useful storage of about 575-million cubic meters. The outlet from the reservoir will consist of a reinforced concrete portal, a gate control structure, and a reinforced concrete lined tunnel eight meters in inside diameter and 670 meters in length through the left abutment leading to the powerhouse. At the downstream end of the tunnel, butterfly valves will be provided for the turbines, and needle valves will be installed for releasing water directly for irrigation. Surge tanks will be set near the powerhouse.

Details of Powerhouse

The powerhouse will be located near the downstream toe of the dam in the left abutment. It is designed to ultimately house three reaction-type turbines and generators, but only two units will be installed initially. Each turbine will be rated at about 27,500 hp when operating at 125 rpm under a net head of 32 meters. Each generator will be rated at about 18,000 kw, 13,800 volts, 3 phase, 50 cycles.

The main spillway will consist of a gate-controlled concrete structure located in the right side of the dam. Water flowing over the main spillway will enter a concrete paved chute and be discharged into the Seyhan River downstream of the powerhouse. An uncontrolled emergency spillway and channel will be located in a natural depression in the right abut-

VIEW OF INTAKE STRUCTURE AT THE SEYHAN PROJECT.

TABLE 1 — FORMULAS FOR ADJUSTING BID TARGETS

Definition of Factors Used in the Formulas With Corresponding Letter Designations

A = Bid unit labor cost from Schedule 2
E = Estimated quantities listed for each bid item in Schedule 2
W = Actual quantities required to complete the work for Schedule 2
M = Bid unit material cost from Schedule 2
F = Bid unit fixed charge cost from Schedule 2
L = Labor rates within specified range
L' = Upper or lower limit of the specified labor rates
R = Actual labor rates outside of the range of specified labor rates paid by the Contractor with the approval of the Ministry and as shown on the Contractor's certified payrolls
H = Actual hours at specified labor rates as shown on the Contractor's certified payrolls
K = Actual hours at labor rates outside range of specified labor rates as shown on the Contractor's certified payrolls
S = Actual quantities of construction materials required to complete the work
T = Actual quantities of construction materials required to complete work plus allowance, where applicable, for wastage and loss
P = Specified material prices
V = Material prices paid by the Contractor as shown on his certified vouchers.

Total Bid Target — Labor

Term L1. Total bid target (labor) $= EA$ (1)

Term L2. Quantity adjusted bid target (labor) $= WA$ (2)

Term L3. Hypothetical total labor cost $= (H + K) \times \dfrac{(LH + L'K)}{(H + K)} = (LH + L'K)$ (3)

Term L4. Total approved wages $= \dfrac{(LH + L'K)}{(H + K)} \times (H + K) + 0.95\,[(LH + RK) - (LH + L'K)]$

$= (LH + L'K) + 0.95\,[(LH + RK) - (LH + L'K)]$ (4)

Term L5. Adjusted labor target $= \text{Term L4} \times \dfrac{\text{Term L2}}{\text{Term L3}} = (LH + L'K) + 0.95\,[(LH + RK) - (LH + L'K)] \times \dfrac{WA}{(LH + L'K)}$

$= \left(1 + \dfrac{0.95\,[(LH + RK) - (LH + L'K)]}{(LH + L'K)}\right) \times WA$ (5)

Total Bid Target — Materials

Term M1. Total bid target (materials) $= EM$ (6)

Term M2. Quantity adjusted bid target (materials) $= WM$ (7)

Term M3. Hypothetical total materials cost $= SP$ (8)

Term M4. Actual total materials cost $= SV$ (9)

Term M5. Adjusted materials target $= \text{Term M4} \times \dfrac{\text{Term M2}}{\text{Term M3}} = SV \times \dfrac{WM}{SP} = \dfrac{SV}{SP} \times WM$ (10)

Term M6. Adjusted materials target with allowance for wastage and loss $= \dfrac{1.04\ SV}{SP} \times WM = \dfrac{TV}{SP} \times WM$ (11)

Total Bid Target — Fixed Charges

Term FC1. Total bid target (fixed charges) $= EF$ (12)

Term FC2. Quantity adjusted bid target (fixed charges) $= WF$ (13)

Term FC3. Adjustment for wage rate $= \pm EF \times 0.25 \dfrac{[\text{Formula (5)} - WA]}{WA}$ (14)

Term FC4. Adjustment for material prices $= \pm EF \times 0.25 \dfrac{[\text{Formula (11)} - WM]}{WM}$ (15)

Term FC5. Adjusted fixed charge target $= \text{Term FC2} \pm \text{Term FC3} \pm \text{Term FC4}$

$= WF \pm EF \times 0.25 \dfrac{[\text{Formula (5)} - WA]}{WA} \pm EF \times 0.25 \dfrac{[\text{Formula (11)} - WM]}{WM}$ (16)

Note: All of the above equations represent summations.

ment. The combined capacity of these two spillways will be about 5000 cubic meters per second.

Three substations also will be constructed in the towns of Adana, Tarsus, and Mersin, as well as about 70 km of transmission lines consisting of conventional steel towers, conductors, and related equipment. This work will be done under separate contracts.

Ministry Furnished Equipment

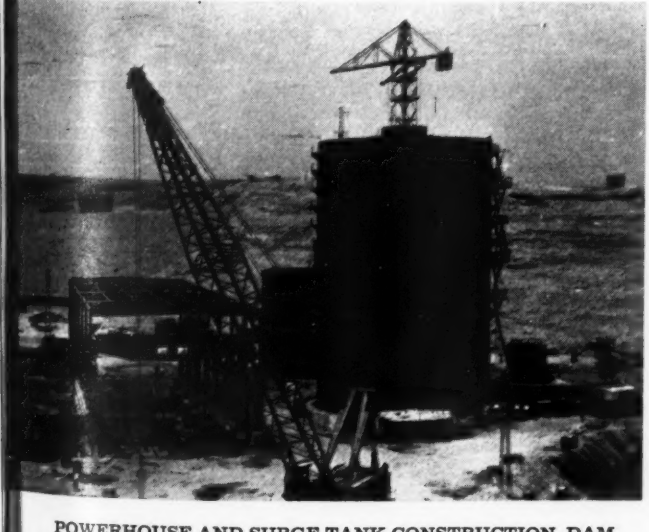
Early in the spring of 1953, the Ministry purchased approximately $4 million worth of new construction equipment from both American and European manufacturers. Most of this equipment was either on the job site or delivered during the third quarter of 1953, and it was turned over to the contractors for their use during the construction of the project. Upon completion of the work, the equipment will be overhauled and returned to the Ministry so it will be available for any other construction programs underway at the time.

All major items of mechanical and electrical equipment required for the Seyhan Dam powerhouse, including the turbines and governors, gates and hoists, cranes, valves, steel penstocks and surge tanks, generators, main power transformers, and switchgear, also will be purchased by the Ministry. The general construction contractor will install and test all items of equipment except the main generators. Manufacturers of the generators will be required to furnish and install the equipment in the powerhouse, complete and ready for operation.

CORE TRENCH FACING TOWARD SPILLWAY. TWO CORE DRILLS ARE BEING SET UP IN LEFT FOREGROUND. PUMPS DISCHARGE TO RIVER OFF PHOTO AT RIGHT.

Type of Contract

One major influence on the project arrangements was the pressing need for power and irrigation water. Thus, the contract documents were designed to attract competent American and European contractors with the experience and skill required to construct the Seyhan Project at a reasonable cost and within the stringent time limitations. This was possible because the Ministry agreed to use a modified-cost-plus-a-fixed-fee contract with bonus and penalty provisions. Both bonus and penalty adjustments will be determined by a comparison of two costs: (1) the actual total cost to the Ministry of that portion of the project for which unit prices were required; and



POWERHOUSE AND SURGE TANK CONSTRUCTION. DAM AND INTAKE STRUCTURE ARE IN THE BACKGROUND.

POWERHOUSE VIEWED FROM TAILRACE. STRUCTURAL STEEL IS IN PLACE. BRIDGE CRANE IS ON RUNWAY.

(2) the total target costs for the same portion of the project as estimated by the contractor and adjusted by the Ministry for quantity, wage rate, and material cost changes.

Proposal Forms

Proposal forms for the Seyhan Project were divided into four bid schedules as follows:

Schedule 1—Reimbursable Costs, General—covers those expenses over which the contractor has no control. Bidders were required to submit an estimated lump sum price for registration of contract and associated legal fees, insurance, Turkish port charges, Turkish custom duties, ocean freight, Turkish state railway freight charges, social law charges, and lubricants and spare parts for Ministry owned equipment. All costs included under this schedule are directly reimbursable in the form of currency in which the expenditures were made.

Schedule 2—Reimbursable Costs, Construction—covers the actual construction costs required to perform the various units of work. Bidders were required to submit estimated unit prices broken down into labor, material, and fixed or general charge components for each of the bid items appearing on the proposal form. Total bid targets of labor, materials, and fixed or general charges were obtained by multiplying the respective unit prices by the estimated bid item quantities and totaling these figures. The actual cost of all labor and material expenditures will be directly reimbursable. The fixed or general charges will be paid for in the same ratio that the fixed or general charge bid target bears to the sum of the labor and material bid targets.

Schedule 3—Fixed Fee—covers the contractor's fee for performing the required work in the specified time. All bonus or penalty payments will be added to or subtracted from the fixed fee.

Schedule 4—Construction Equipment—covers the costs of any additional construction equipment required by the contractor, in addition to that purchased by the Ministry, to complete the work within the specified time. Bidders were required to list each additional piece of construction equipment needed and its approximate cost. (The Ministry purchased all the construction equipment listed by the successful bidder.) In evaluating the bids, only 25 percent of the total estimated cost of *Schedule 4* was added to the bid totals for the other schedules.

Adjustment of Bid Targets

Upon completion of the work, the bid targets for labor, material, and fixed or general charges will be adjusted to compensate for changes in estimated bid item quantities, wage rates, and material costs as compared to those appearing in the original specifications. The adjustment will be made only at the end of the job and will be based on the summation formulas listed in Table 1. This summation procedure was derived in an effort to bind the contractor to his estimated efficiency in the use of labor and materials required to perform a unit of work—without reverting to the detailed breakdown necessary to arrive at each unit price. Preferably, the estimated efficiencies will be related to the actual bid item quantities, work rates, and material costs which will be in effect during the course of the work.

Bonus-Penalty Determinations

Contract documents for the Seyhan Dam and appurtenant works provide three types of bonus and penalty determinations. However, the net fee paid the contractor may not be reduced by more than 40 percent of the bid total for *Schedule 3* as a result of these determinations. Briefly, the three types of bonuses and penalties are as follows:

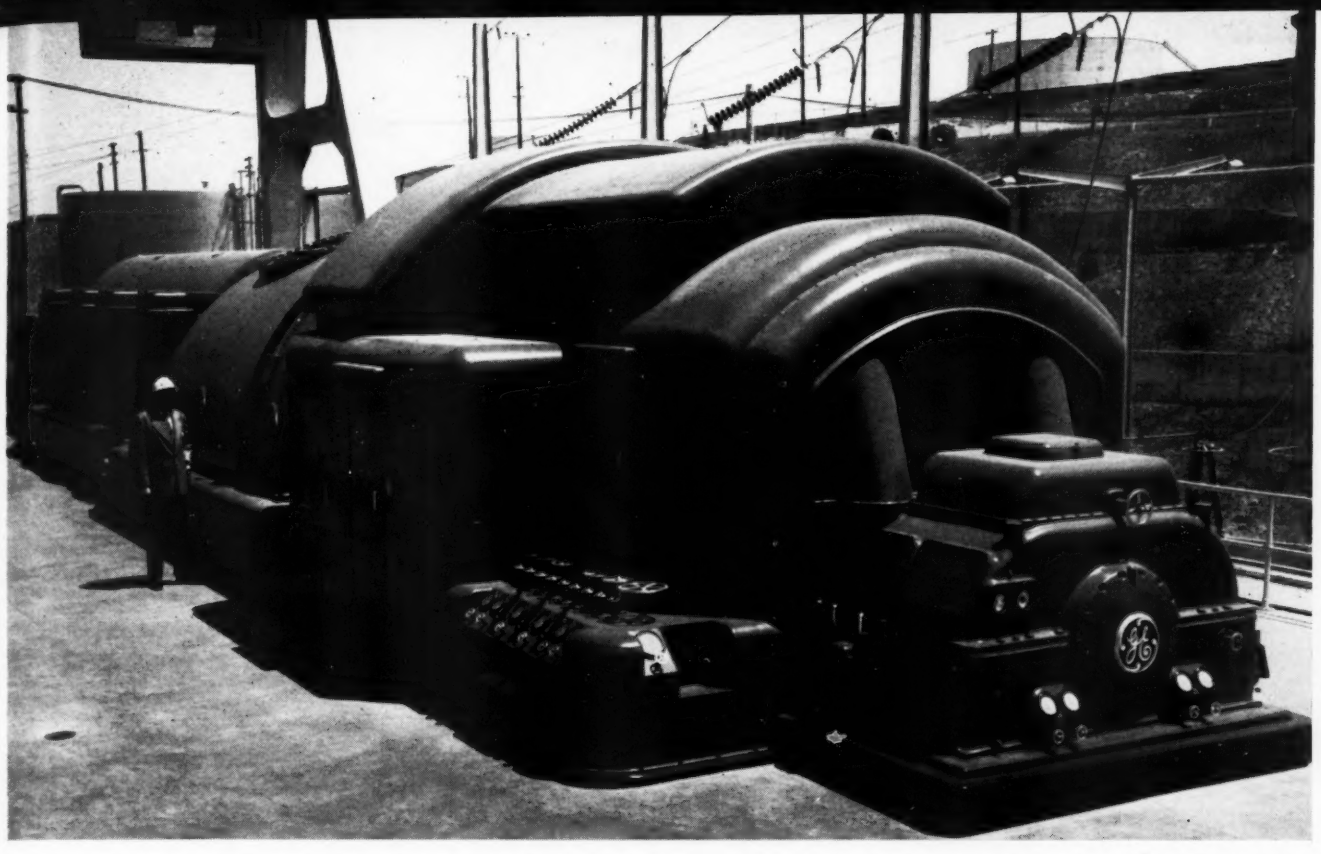
Cost-of-the-Work. For completion of the work included under *Schedule 2* at an actual cost to the Ministry less than the adjusted total target costs, the bid fee stipulated in *Schedule 3* will be increased by a graduated percentage varying with the amount of the difference. Conversely, the bid fee will be reduced if the actual cost to the Ministry exceeds the adjusted total target costs.

Time-of-Completion. For completion of those portions of the work which will permit initiation of filling of the reservoir prior to November 15, 1955, the bid fee will be increased on a daily basis. Similarly, if the entire work is completed prior to June 30, 1956, the bid fee will be increased on a daily basis. Penalties will be levied for failure to comply with the specified completion schedule.

Extra Work. If the Contractor is required by the Ministry to perform extra work, the Contractor will be paid for this extra work as part of his bonus or by an equal reduction in the amount of his penalty. This amount will be equal to the product of the total fixed fee times the ratio of the cost of the actual labor and materials required to perform such work to the adjusted total bid target for work included under *Schedule 2.*

It should be noted that the determination of the cost-of-the-work bonus is based on the unit prices bid for labor and materials through the medium of adjusting the total target estimate by the ratio of the bid target to the theoretical costs. In effect this amounts to applying actual costs of labor and materials to the contractor's bid without a detailed breakdown of the various trades and materials required to perform each unit of work on the list of bid items.

Since the bulk of the project cost appears in the work included under *Schedule 2,* the total bid target was of prime importance in evaluating bids. In order to prevent unbalancing of bids, it was stated in the contract documents that particular weight was to be attached to the percentage to be used to compute the fixed charges when determining the successful bidder. ▲▲



WEATHER-ENCLOSED, 156,250-KW TURBINE-GENERATOR AT EL SEGUNDO PLANT OF SOUTHERN CALIFORNIA EDISON CO.

Enclosures for the Vital Areas of Outdoor Power Plants

ROBERT H. WEIGHT

Robert H. Weight received his B. S. degree in civil engineering at Utah State Agricultural College in 1940. He then accepted an assistantship to the California Institute of Technology and there earned an M.S. degree in 1941. Following graduation he spent a year with the U.S. Army Engineers in airport hangar design; six years with consulting structural engineers in California on the design of heavy industrial plants, school buildings, churches, and warehouses; and 2-1/2 years as structural engineer for the contractor on the Davis Dam Project, being responsible for the design of construction trestles, conveyors, cofferdams, forms, and camp facilities.

Since December of 1951, Mr. Weight has been on the engineering staff of the Bechtel Corporation. Currently, he is head of the structural and civil design section of Bechtel's Power Division Los Angeles Office and is responsible for the structural and civil design of three major steam power plants. He is a registered civil and structural engineer in California, an associate member of A.S.C.E., and a member of the Structural Engineers Association of California.

IN RECENT YEARS, many of the power utility companies — particularly those in localities not exposed to extreme weather conditions — have been constructing outdoor type stations rather than the fully enclosed type because of the significant cost savings. These savings are realized by the elimination of walls and roofs around and over turbine-generators and boilers, and by reduced requirements for supporting members and foundations.

A turbine-generator can be arranged for outdoor exposure by weatherproofing its closure housing. Proper design of this housing results in a very attractive showpiece item of equipment while achieving weathertightness. During turbine overhaul periods, only a temporary, portable shelter is required.

A boiler and its piping, valves, ducts, fans, air preheaters, heaters, deaerator, evaporator, and access platforms also are suitable for outdoor exposure.

Certain areas, even in outdoor stations, should be

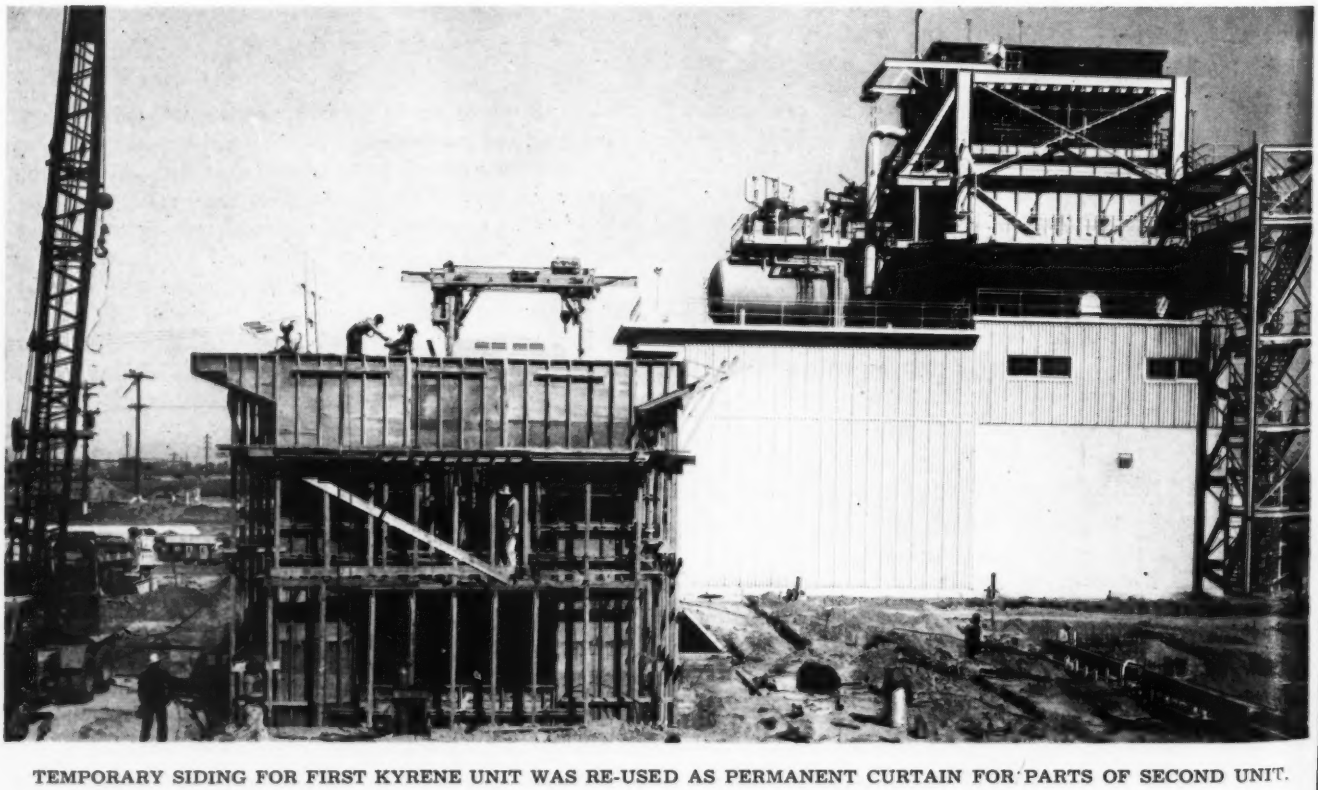
TABLE 1 — NONSTRUCTURAL CLOSURE WALL STUDY

Type of Closure	Manufacturers of Products	Thickness of Material	Relative Cost Installed	Appearance Characteristics	Weather-Tightness	Corrosion Resistance	Fire Resistance	Re-use Potential
Asbestos Cement Transite	Johns-Manville Philip Carey Keasbey & Mattison	3/8" nominal	Low	Nonuniform sheets of varying color hard to avoid	Poor	Good - requires careful flashing	Incombustible	Fair
Protected Metal	H. H. Robertson Amer. Steel Band Plasteel Products	#22 or 24 ga	Low	Good	Good	Good - requires careful flashing & edge treatm't	Fair	Good
Aluminum	H. H. Robertson Amer. Steel Band R. C. Mahon	#16 B&S ga	Medium	Good—sheets may vary in color, but weather uniformly	Good	Good	Fair	Good
Stainless Steel	H. H. Robertson Amer. Steel Band R. C. Mahon	USS17-#20 ga	High	Good	Good	Good	Fair	Good
Concrete Block	Local Manufacturers	8" nominal	Medium	Good—gives feeling of permanence	Good	Good	Good	Fair
Reinforced Brick	Local Manufacturers	9" nominal	Medium	Good	Good	Good	Good	Fair
Precast Concrete	Contractors	6"	Medium	Good	Good	Good	Good	Poor

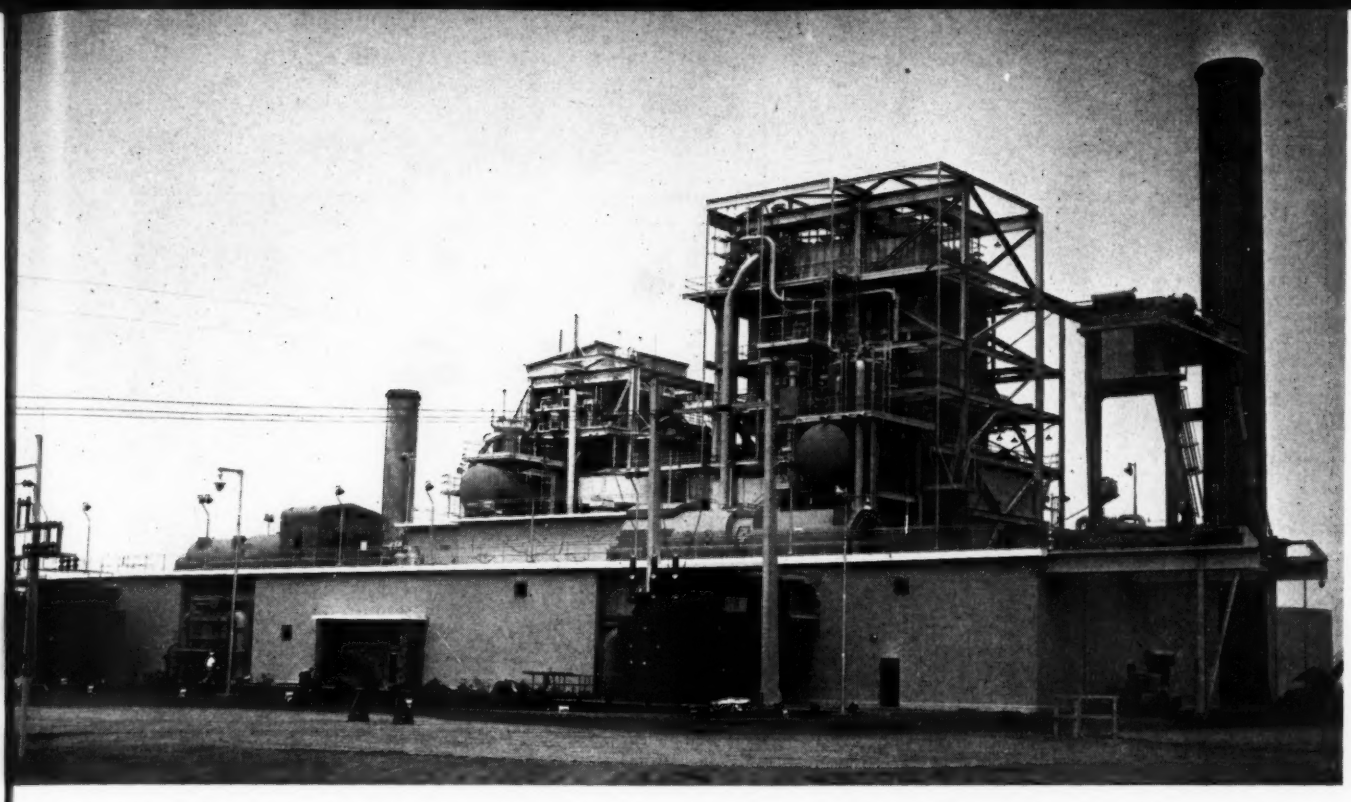
enclosed to provide protection for vital auxiliary equipment and comfort for operating personnel. How to attain this protection and still have an outdoor station design is a problem.

Curtain Walls Natural Answer

In most well-integrated power station arrangements, the use of curtain walls becomes a natural answer. A massive concrete pedestal foundation, for the support of a turbine-generator at an operating level above the ground floor, becomes a watertight roof over the floor underneath it. The area adjacent to the turbine-generator, when properly fulfilling its function of lay-down space during overhauls, also is a heavy concrete operating deck or roof. Vital auxiliary equipment can be protected very naturally by



TEMPORARY SIDING FOR FIRST KYRENE UNIT WAS RE-USED AS PERMANENT CURTAIN FOR PARTS OF SECOND UNIT.



KYRENE STEAM STATION FOR SALT RIVER POWER DISTRICT SHOWS THE USE OF CONCRETE BLOCK CLOSURE WALLS.

locating it beneath these decks and closing the sides with curtain walls.

Since the installation of piping, conduits, and equipment in a power station extends over a long period of time (practically the full construction period), early erection of the main supporting frame is important. Yet the area must be kept open to provide access for erecting equipment. For these reasons, structural steel generally is used for the main supporting frame, and it is erected as soon as foundations are poured. Whatever closure walls are used in the design are installed near the end of construction, and they are nonstructural.

Types of Nonstructural Curtain Walls

Several types of walls may be used, with selection for a particular job being made on the basis of economy, utility, and appearance. For convenience, the characteristics of various nonstructural closures considered in recent designs are summarized in Table 1. Each type of closure wall has advantages and disadvantages, as indicated in this study. A pleasing architectural appearance — always an important consideration — can be attained through the use of any or all of these materials with reliable and proper design. All of these closures also provide satisfactory corrosion resistance when properly applied.

Where low cost is important, protected metal siding and asbestos cement transite should be considered. Transite siding has the advantage of being corrosion resistant and incombustible in case of fire but is not readily weather resistant to rain and dust. Maintenance is apt to be high because it will break if bumped accidentally. Transite should not be used where an interior wall finish is desired.

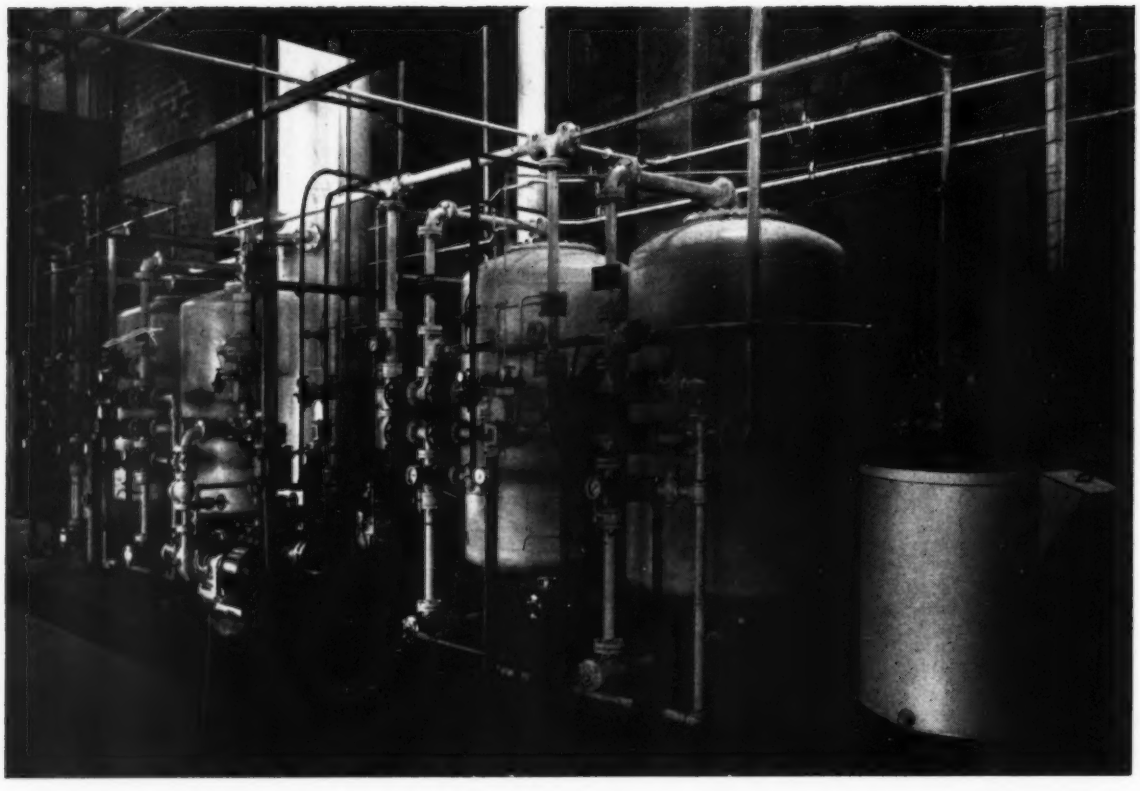
Protected metal and aluminum or stainless steel siding present a good appearance and can be made weathertight more readily than transite. Where reuse is desired, as in the case of providing a temporary closure wall for future plant expansion, metal siding is excellent. Maintenance is likely to be greater than for concrete block and less than for transite.

Concrete block or reinforced brick walls are attractive and give a feeling of permanence. Both materials can readily be made weathertight and are adaptable to fitting or closing around openings or piping penetrations. Once installed, they are virtually maintenance free.

Precast concrete walls can be finished in various effective textures to provide a pleasing surface treatment. Where piping penetrates these walls, they must be erected prior to the piping. This is sometimes a schedule disadvantage. In a busy power plant, there are necessarily numerous items of equipment and piping in various stages of construction. Wall panels cannot be cast upon the floor slabs — the usual procedure for best economy — but must be cast in a remote location upon separate casting slabs.

Conclusion

The idea of using nonstructural closure walls to house vital auxiliary equipment is not new, but it is sound. While it is conceivable that a power station might be constructed fully open without walls, it is believed that limited use of closure walls contributes materially to the appearance, function, and comfort of an outdoor plant. The type of materials for closure walls, and the extent of their use, becomes a separate consideration for each power station, which must be resolved at the time of design. ▲▲



INSTALLATION PHOTOGRAPH OF AN ION EXCHANGE PLANT WITH DUAL CATION AND ANION UNITS.

Specifying Industrial Waste Treatment

R. J. KEATING, Manager
Industrial Waste Treatment Department
Graver Water Conditioning Co.

THE FIELD of industrial waste treatment is not new; nor is the regulation of industrial wastes by public control agencies. Probably the first example of such control was the Alkali Act, passed in England in 1863, in which the alkali plants around London were required to neutralize waste hydrochloric acid gas before discharge.

What is new, and of increasing importance to consulting engineers, is the steady growth of public pressure on industry to stop polluting our rivers and streams, and a corresponding realization by industry itself that it, also, has a big stake in the preservation of water as a natural resource. Also new, is an awareness that in solving waste treatment problems, use of good engineering principles when designing the system frequently can salvage much of the cost by means of reclaimed water, product, and heat.

Application of industrial waste treatment on a broad scale dates back only about ten years, or to about the end of World War II. This development is easier to understand when we consider a few statistics. In the past 50 years, the population of the United States has more than doubled, and our industrial production has expanded more than sixfold. More than 90 percent of the water used in this country is for nonconsumptive applications — removing and dissipating industrial and human waste. Yet the streams and rivers that carry away these wastes are essentially the same as they were in our grandfather's time. We simply have imposed a waste burden that the streams cannot dissipate, and thus have made the water unsuited to many purposes.

Nor is this a static problem. It has been estimated that by 1975, our water requirements will be double our present consumption, and we will be using about

90 percent of all the water that can be developed at a reasonable cost. This hardly takes into account the growing problem of water-borne radioactive wastes, where contaminants may be introduced into our water supply with half-lives of thousands of years. Consequently, waste treatment is no longer merely a matter of saving fish, as many people think, but more and more an economic necessity.

Action Required

Obviously, industry is not solely responsible for this treatment program, nor is it practical or reasonable to demand that all industrial wastes be treated. Municipalities and other public agencies must carry their rightful share of this burden. But we recognize the fact that in most areas where stream pollution is already a problem, wastes from industry usually are the main offender. It is in our own interest to see that our water supplies do not become so contaminated that they no longer can serve the legitimate interests of other towns and industries.

Recognizing that this is a problem that must be faced, the next logical step is, "What can be done about it?" It is no secret that waste treatment can be expensive. This expense must be added to the cost of the product and paid for by the ultimate consumer — and no one likes to increase costs in a competitive market. Too often, therefore, all consideration of waste treatment is postponed until the last possible moment. When some sort of action becomes imperative, the consulting engineer is asked to provide a quick solution. "Quick solutions" to waste treatment problems are available, but they frequently prove far more expensive than a well thought-out program.

Two examples will illustrate this point. A new plant in the Los Angeles area originally estimated the total waste discharges at between 20 and 30-million gallons per day. After careful study of possible re-use of water within the plant, the total amount of water discharged to waste was reduced to less than one million gallons per day, with an enormous saving in waste treatment equipment costs. At another plant acidic acid was creating a serious pollution problem. A simple study of the process showed that 80 percent of the loss occurred through pump packing leaks. Using a different pump completely eliminated the waste problem.

Approaching the Problem

Before any decision is made on a waste treatment process, certain basic information should be established. This includes:

¶ An examination of the process to see what wastes are being discharged. A considerable amount of profit may be going down the drain.

¶ Consideration of process changes that may reduce the waste problem. One plant found that through the simple expedient of changing from a phenolic cleaning compound, waste treatment was eliminated.

¶ Investigation of possible water re-use for less critical operations. Remember, water does not wear out.

¶ Determination of the actual amounts of water discharged, including the extent and duration of surges. This is checked against the amounts realistically required for efficient operation.

¶ A campaign for good plant housekeeping. Leaks and spills are big contributors to pollution problems.

¶ Familiarization with local and state requirements on plant waste discharges. Representatives of the control agencies are reasonable men who also want to help solve waste problems.

Once these basic data are known, possible waste treatment processes can be investigated. Since no two problems are exactly alike, even in plants performing the same function, for greatest efficiencies and economy waste treatment facilities should be tailored to the individual plant they are to serve. One important consideration in the evaluation of any process is its net operating cost. In other words, will the process selected provide any return in the form of product, by-product, water, or heat to help pay part of the waste treatment cost.

Methods of Treatment

Waste treatment problems generally are solved in one of three ways: (1) by removing the nontoxic material from the system, (2) by changing the toxic material to a nontoxic form, and (3) by physically removing the impure material.

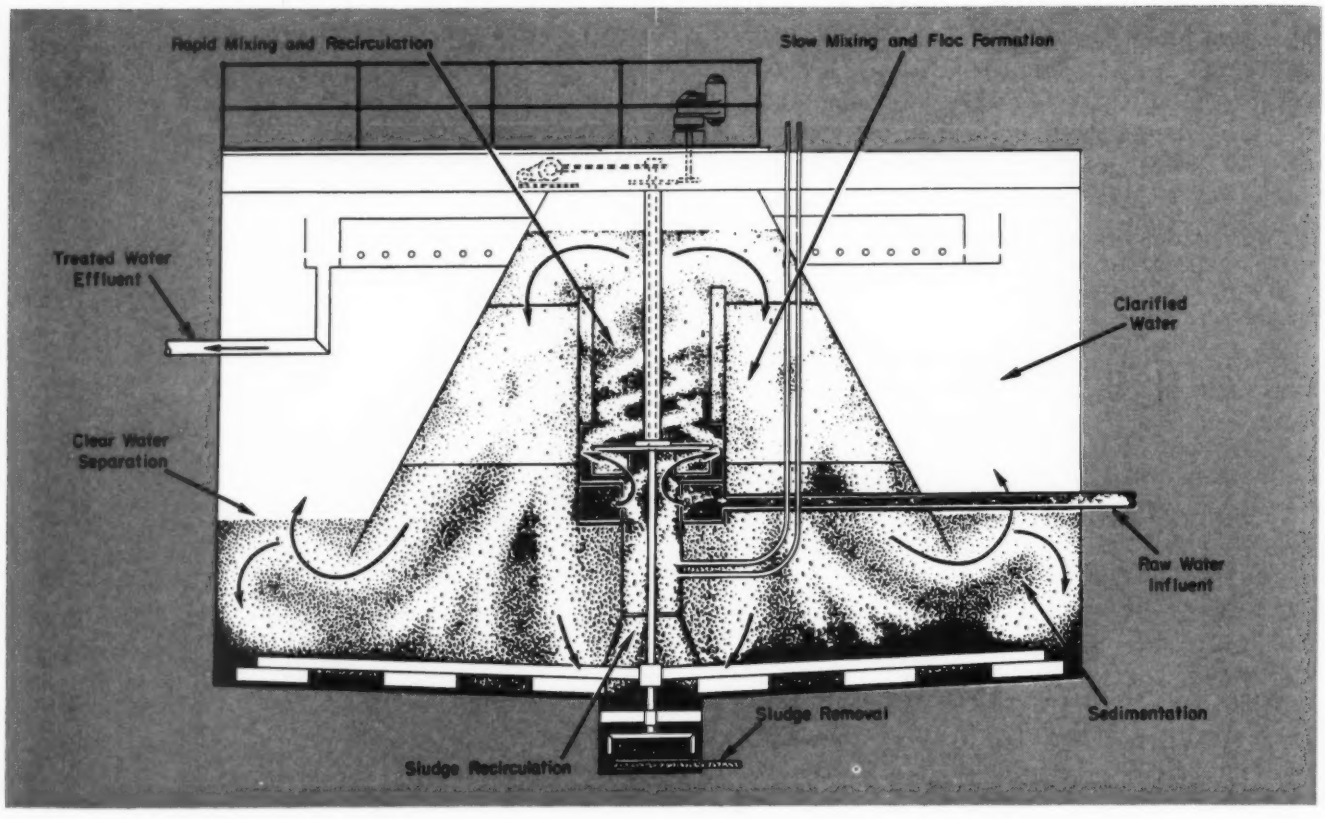
Evaporation of highly concentrated wastes is an example of the first method. This is used for sulfite liquor waste and for certain radioactive wastes. High cost of this method makes it impractical for most waste treatment problems.

Municipal sewage treatment is probably the best example of the second method. Pollutional materials in sanitary waste are biologically oxidized to nonobjectionable form. Originally, these same sanitary treatment techniques were attempted for all industrial waste problems, but in modern engineering practice, they generally are used only where they seem directly applicable. Dairy, cannery, laundry, slaughterhouse, packing house, and some fermentation wastes are amenable to biological treatment. Another example of the same method in a nonbiological process is the oxidation of cyanides to carbon dioxide and nitrogen using chlorine.

Physically Removing Impurities

Most waste treatment problems are solved by the third method — the physical removal of the impure material from the waste stream. This is accomplished in a great many ways, and frequently laboratory or pilot plant tests on the waste solutions will be required to determine what method, or combination of methods, will give the desired results. Principal methods and their characteristics are as follows:

Screens for Large Solids Removal. Screens can be



CROSS-SECTIONAL DRAWING OF A TYPICAL SOLIDS-CONTACT TYPE UNIT DESIGNED FOR SLUDGE RECIRCULATION.

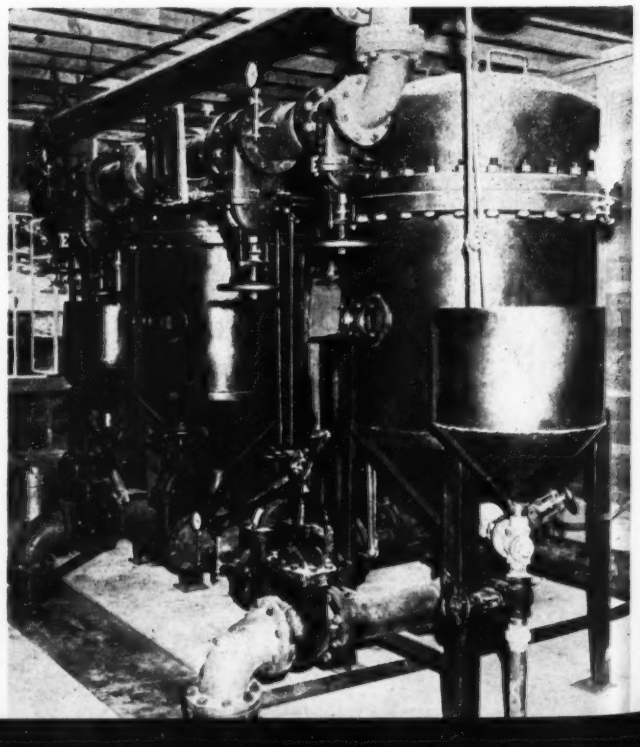
helpful in removing bulky solids that might interfere with subsequent treatment. These screens may be fixed bars equipped with movable rakes to remove the collected material, such as are used in sewage treatment plants, or they can be revolving drums covered with wire screens, such as the "savealls" used in many paper mills. Their ability to remove impure materials is limited by the pore opening size, and consequently they are used most frequently as pretreatment ahead of other equipment.

Sedimentation Units. Most solids have a specific gravity greater than 1.0, and will settle out of water when the velocity is reduced. The most common equipment in waste treatment practice, therefore, is a sedimentation unit. This machine provides a large settling area at low velocity flow. In many designs the waste stream first is forced to travel downward and then is reversed to an upflow, which usually gives better solids separation than horizontal flow. Where the bulk of the waste is heavy with some floating material, the central section can be enlarged somewhat to permit good separation of the float, which then is skimmed off from the central collection zone. It also is possible for a scraper to cover the entire bottom of the unit and move the settled solids to a central sump for disposal.

Units of this type are used successfully in waste treatment for flue dust recovery in steel mills, certain pulp and paper mill operations, certain food processing applications, and generally, whenever the impurity has good settling characteristics. In addition to simple solids removal, sedimentation units also are effective in removing sludges resulting from neutralization of acid and alkali solutions.

A good example of a horizontal flow arrangement is the A.P.I. oil separator. This unit provides long horizontal chambers where the oil-water mixture separates by gravity at low velocity flow. The oil is

TWO DIATOMITE FILTERS, EACH WITH PRECOAT POT.



removed for recovery by skimming flights. One disadvantage of horizontal separators is the considerable amount of area that they require.

Mechanical Flocculation Units. Many waste particles have a specific gravity close to that of water, or have a relatively large surface area that interferes with rapid settling. In order to remove impurities of this sort, chemical coagulants are added to the water. Such coagulants form a voluminous, insoluble precipitate on which the dissolved or colloidal wastes are absorbed, and the suspended matter is enmeshed and precipitated. These steps originally were performed in separate stages but now usually are combined in one solids-contact machine.

Air Flocculation Units. Where the bulk of the material has a low specific gravity, pressurized flotation frequently is successful. Coagulants usually are employed, and finely dispersed air bubbles of optimum size are entrained in the floc particles, adding to their natural buoyancy. Whenever the inlet stream contains heavy particles as well as light floatable ones, they can be separated by adding a scraper at the bottom of the tank. The scraper cleans the full bottom of the tank and avoids costly shutdowns for cleanout. Such machines have been used successfully for small refinery wastes, paper and pulp, fatty acid wastes, and wastes from aircraft and railroad maintenance.

Ion Exchangers. Ion exchange is a flexible tool in many process applications, and it is natural to find it increasingly used for waste treatment. The resinous ion exchange material has the ability to remove dissolved impurities from very dilute solutions and to retain these impurities until their release is desired.

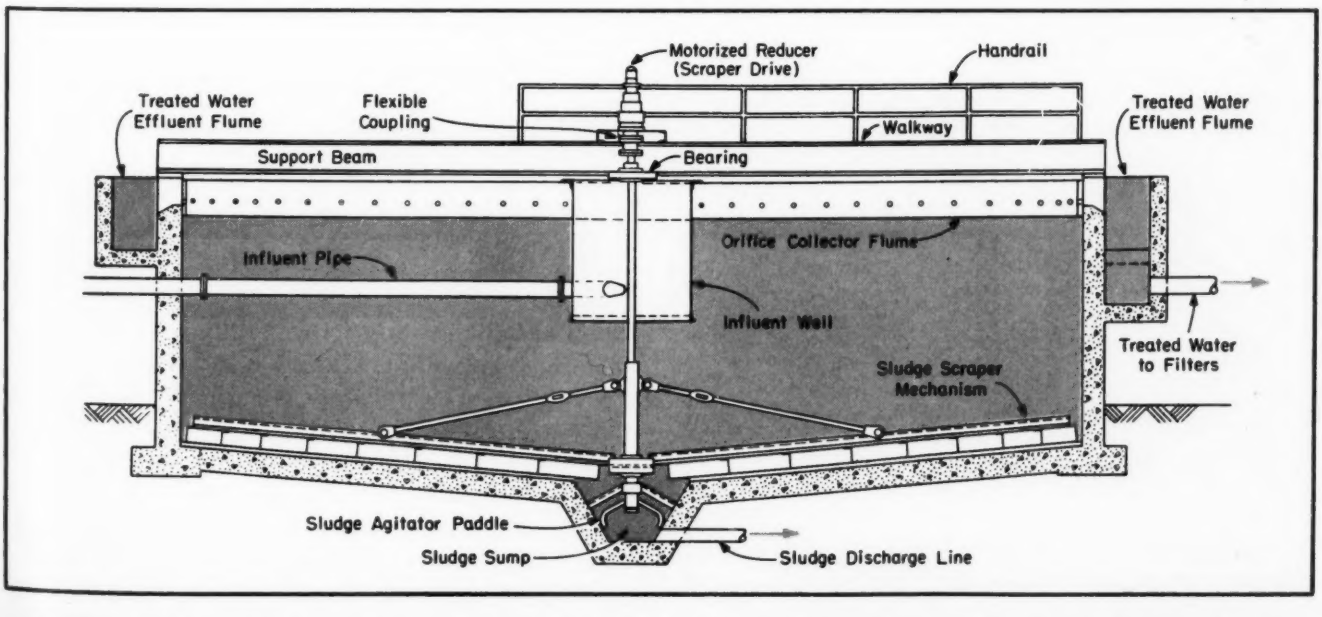
One place where ion exchange has been particularly useful to date is in the plating field. Chromic acid solutions are objectionable in waste discharges down to around 1 ppm or less. Re-use streams from chromic acid plating are treated by ion exchangers to produce demineralized water that gives a brighter plate, and the wasted chromic acid is accumulated on the ion exchanger until it is released for re-use in the plating baths.

Plating industry figures show that about 80 to 90 percent of the purchased chromic acid in the average plant is wasted. A properly designed ion exchange plant can cut this loss to a mere trickle, providing tremendous savings in chemical costs. Work also has been done with ion exchangers on the difficult problem of disposing of spent steel pickling liquors and the equally difficult problem of waste disposal from sulfite pulping. In the constant effort to make waste treatment pay its way, ion exchange holds a promising future.

Filters. In waste treatment practice, filters are a "special assignment" group. Sand or diatomite filters are used when extreme clarity is needed for some process water re-use. Activated carbon filters are useful for removing organics, as in plating rooms. Vacuum and plate and frame filters frequently are used for final dewatering of sludges.

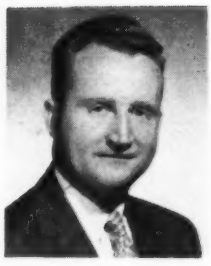
Looking Ahead

Now that American industry is aware of the importance of industrial waste treatment, definite strides are being made. Expenditures for waste treatment in 1953 were estimated at $678 million as against approximately $100 million in 1940. The United States Public Health Service estimates that $10 billion must be spent in the next 10 years to clean up the nation's streams. This is a lot of money, and the consulting engineer can assist in spending it as wisely as he would for any other process equipment. Makeshift waste treatment plants are like makeshift tools — they often fail just when needed most. ▲▲



TYPICAL ARRANGEMENT OF A SEDIMENTATION UNIT WITH SLUDGE SCRAPER COVERING THE ENTIRE BOTTOM AREA.

ROBERT B. WILSON

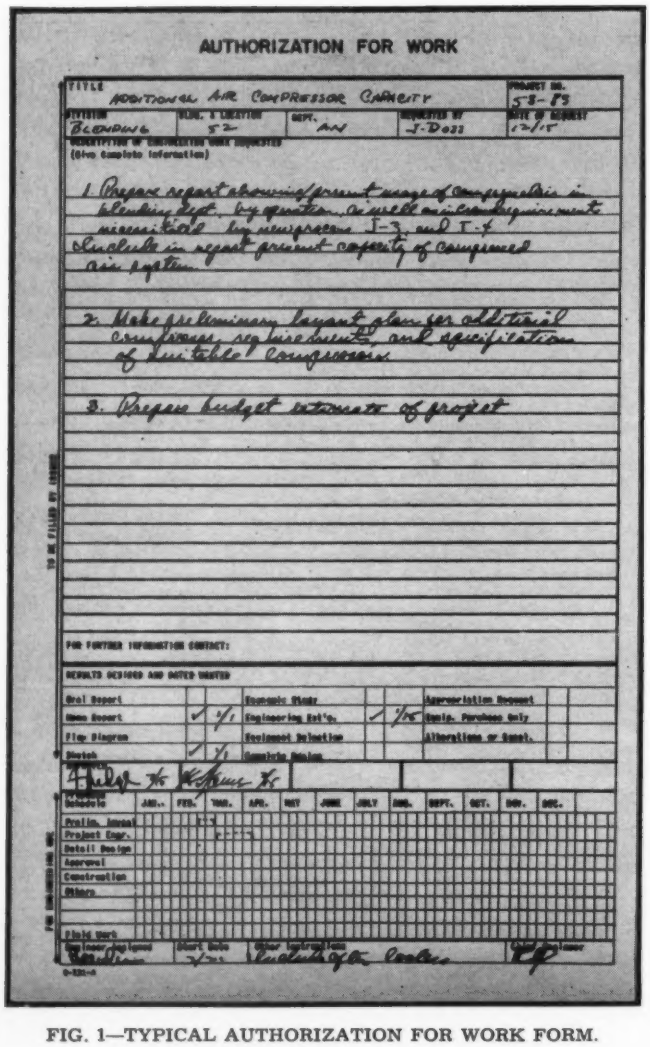


ROBERT GALLOWAY, P.E.

Robert B. Wilson is a civil engineer who found his way through design offices and industrial operations to management counseling. After graduating from Drexel Institute of Technology in 1940, he joined the Glenn L. Martin Co. as a structural test engineer; later served in the U.S. Air Force; and then became supervisor of maintenance planning for American Airlines, Inc. During the past five years with Wallace Clark & Company, Inc., Management Consultants, his major undertakings have been planning and control systems in engineering offices and in construction and maintenance organizations.

Robert Galloway is a licensed professional engineer in the States of New York and New Jersey. His professional experience has included direction of engineering work and major plant expansion projects. He has served as a plant engineer and as a production executive. Since 1949 he has been a senior staff engineer for Wallace Clark & Company, Inc., Management Consultants. Mr. Galloway, a graduate of Wesleyan University in 1936, has had advanced work in civil and industrial engineering. He is the author of a number of articles appearing in technical and industrial publications.

Planning for Engineering Work



AUTHORIZATION FOR WORK

TITLE: ADDITIONAL AIR COMPRESSOR CAPACITY — PROJECT NO. 53-F3

DIVISION: BLENDING — BLDG. & LOCATION: 52 — DEPT.: AN — REQUESTED BY: J. Doss — DATE OF REQUEST: 12/15

DESCRIPTION OF CONSTRUCTION WORK REQUESTED (Give complete information)

1. Prepare report showing present usage of compressed air in blending dept. by operation, as well as increased requirements necessitated by programs I-3 and I-4. Include in report present capacity of compressed air system.

2. Make preliminary layout plans for additional compressors, requirements and specifications of suitable compressors.

3. Prepare budget estimate of project.

FOR FURTHER INFORMATION CONTACT:

RESULTS DESIRED AND DATES WANTED

Oral Report		Economic Study		Appropriation Request	
Memo Report	✓ 4/1	Engineering Est's.	✓ 7/15	Equip. Purchase Only	
Flow Diagram		Equipment Selection		Alterations or Const.	
Sketch	✓ 1/1	Complete Design			

Approved: [illegible] — Approved: [illegible]

Scheduled: JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC.

Preliminary Layout
Project Engr.
Detail Design
Approval
Construction
Others

Field Work

Engineer Assigned: [illegible] — Start Date: 1/15 — Other Information: Include type of Coolers — Chief Engineer: CP

FIG. 1—TYPICAL AUTHORIZATION FOR WORK FORM.

GOOD PLANNING, or improved utilization of the engineering talent at hand, presents one of the most fruitful avenues for overcoming the much-discussed "shortage" of engineers. Application of the simpler fundamentals of planning, scheduling, and control can increase output, shorten in-process time, and reduce costs. Particularly in less easily defined areas, such as development engineering and initial design stages, it is often thought that planning and control cannot be applied. However, experience in many engineering offices, and even in research organizations, shows that definite improvement can be made in the performance of individual groups, and that better executive decisions at high levels can be based upon information drawn out of a planning system.

Objectives of Planning Systems

Any planning system has objectives—determining and authorizing the specific items of work to be undertaken (both long range and short range); estimating man hours and dates; and scheduling and follow-up of current work. Naturally, the steps in accomplishing these objectives will vary depending upon the particular organization and type of consulting work but variations in procedure will not alter the basic requirements.

Authorization for Work

Establishment of a formal authorization for engineering work contributes to an organized "plan of attack" prior to the time the work is undertaken. The intent of a formal authorization is to insure that

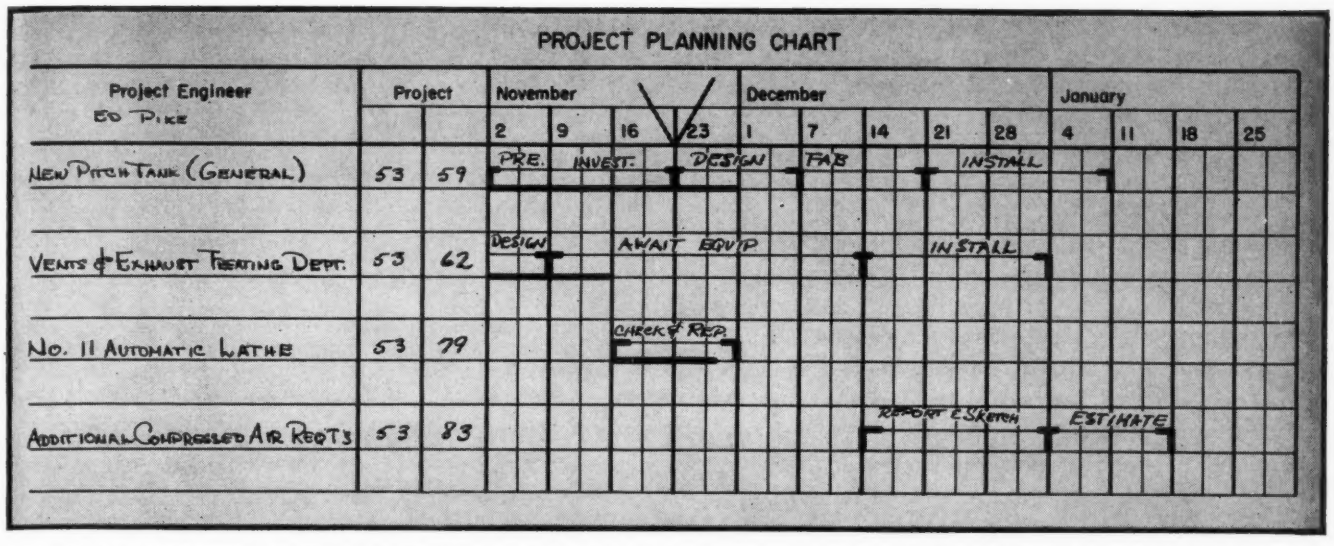


FIG. 2—GANTT TYPE PROJECT PLANNING CHARTS PROVIDE INFORMATION ON JOB PROGRESS IN RELATION TO TIME.

sufficient study is given each idea before it absorbs appreciable expense, only to be abandoned later on.

Fig. 1 illustrates a typical authorization for work that furnishes a concise, yet complete, description of the work required. Sketches, if available, should be attached, together with pertinent information in the form of reports, memoranda or correspondence. The more complete the information furnished, the better the design groups can meet the requested scope and dates. Desired time objectives should be realistic, to permit proper planning and execution of the work. Notes like "soon as possible" and "immediately" are to be avoided in favor of actual dates.

Any supervisor may issue authorizations for work. Since the instructions may cover new designs, expansion or rearrangement of facilities, or development or research work, a management committee often reviews authorizations for work before action is started. The committee usually has representatives of the several departments. This arrangement helps to maintain a good relationship between projects underway, and to avoid duplication of effort.

The Project Plan

In the engineering office, each project is assigned to a project engineer, and he sees it through to completion. Each project engineer has a project planning chart on which all his assignments are entered.

When a project is assigned, the project engineer examines its scope and estimates the calendar time required for each major step toward completion. Although he undoubtedly consults his superior, the project engineer largely makes his own plans. Inasmuch as he sets his own goals, he is likely to try to live up to them. He cannot say that the schedule has been dreamed up by someone else who knows nothing about the work, that he cannot meet it, and furthermore, is not going to try.

The project engineer also estimates the man-hours of his own and other skills that will be required to do the engineering work. The reverse side of the authorization for work is a convenient place to note his results before entering the job on the project planning chart. In preparing estimates, he may refer to other groups who will be involved in the work.

At this point, he may have to return the project for reapproval, especially if the probable ultimate expenditure exceeds the initial estimates. The formality of the re-evaluation and of the final go-ahead will depend upon the company organization, but a written approval should be obtained before starting design or detail work.

All elements of each project are entered on the project planning chart, with planned start and finish dates indicated. Recording each detail on a chart where it can be seen by others has a tendency to make it definite and accurate, and to promote the assignment of clear-cut tasks to individuals. When putting the new job on the chart, the project engineer has before him all other projects for which he is responsible, and consequently his planning is accomplished in the light of all influences. He can note the man-hours (as opposed to calendar time) required month by month for each job, so that overloading can be avoided.

Gantt Charts

Fig. 2 shows a typical project planning chart. This is actually a "Gantt Chart," which is a compact, easily prepared chart presenting facts in their relation to time. Use of the Gantt chart makes it necessary to have a recorded plan, and it furnishes the means of entering progress against the plan. The Gantt chart has been called one of the most notable contributions to the art of management in this generation. It is amazing what little use engineers make of this important tool.

Project planning charts should be prepared on

vellum. Periodically, progress of each project should be posted, and copies may be run off quickly for use of the Chief Engineer and other management personnel. Bound in loose-leaf form, copies are readily available for review at management meetings.

Getting the Work Done

Planning charts are only one step, though an important one, in getting the work done. Having decided what jobs to do on what dates, the next step is to assign tasks to individuals in project and design groups day by day. In many instances, these requests for engineering work are handled through the medium of an assignment board.

Engineers' names are listed at the left of the board. Opposite each name are three pockets or clips—one each for "Job in Work," "Next Job," and "Jobs Ahead." The order in which assignments are to be undertaken is worked out by supervisory engineers, and the assignment board is set up accordingly.

As jobs are completed, the engineer makes appropriate changes on the board. Thus, at all times the assignment board gives a current picture of what jobs are in work. On large projects, where several engineers are required, individual work assignment forms are used for each engineer.

Design and Drafting Groups

Design and drafting groups receive their work from the project engineers, and the problem is to keep everyone satisfied, to forecast completion dates, and to maintain a small backlog ahead of each group. To accomplish these things, the squad leader maintains a Gantt-type chart (Fig. 3) as a working tool, on which he estimates and lays out the duration of the assignments for all of his men.

With this arrangement, the squad leader can schedule the best man for each job, with consideration for other assignments and for the time required. He always will have before him all the work on hand, and will be able to give realistic estimates for completion of any job. Moreover, use of such a chart is one time-proven way to promote interest and responsibility on the part of individual men. This often results in higher output.

Keeping Abreast of Progress

Gantt-type charts are valuable for determining progress because they indicate how the work stands compared with the plan. A large V at the top (Figs. 2 and 3) shows the date when the chart was posted, while heavy black lines show the status. If everything is exactly on schedule, the black lines extend to a point directly below the V. If they stop short of this point, the job is running behind; if they extend further, the work is ahead of schedule. A glance at any of the charts shows how the work stands and directs attention to those items that are behind schedule. Action can be taken on delays in the early stages so that progress can be improved well in advance of completion dates. In this way, last minute critical situations can be minimized.

Historical Records

Planning charts are working tools. They do not pretend to supply historical records. Accordingly, a progress record (Fig. 4) is used, listing key information relating to each project. This permanent reference provides: the identifying numbers, dates originated and approved, dates construction started and finished, and the name of the responsible project engineer. In addition, a file for each project amplifies

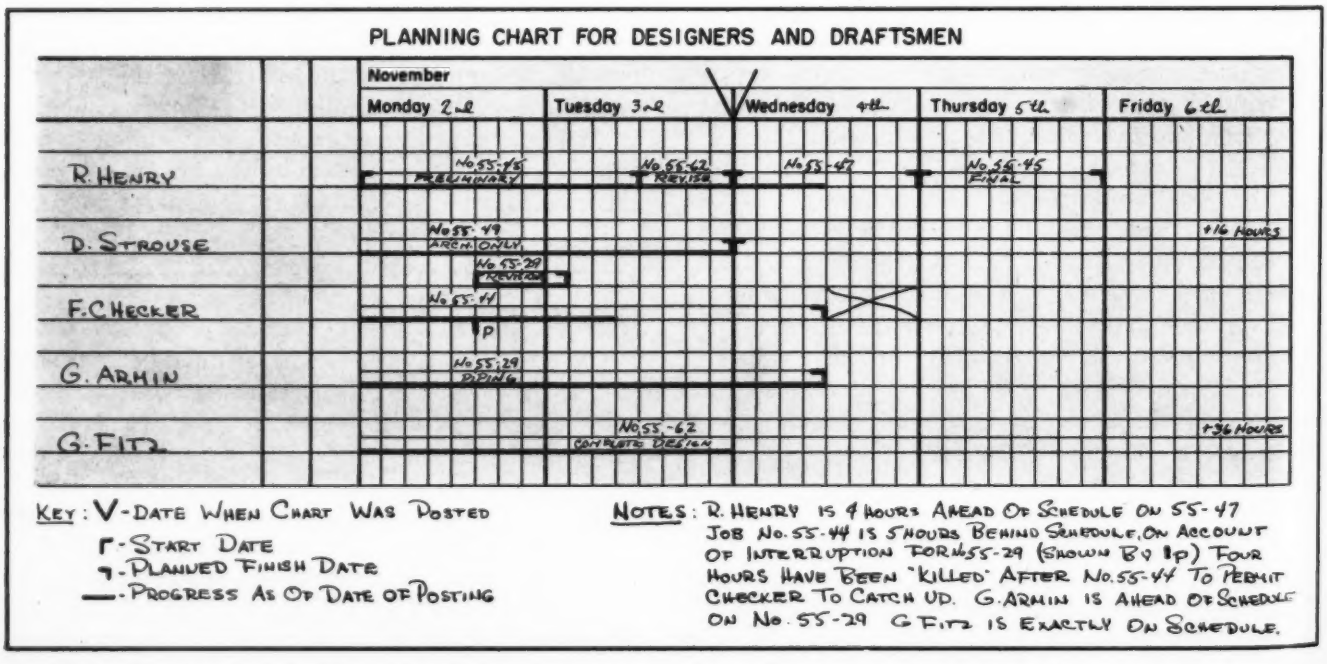

PLANNING CHART FOR DESIGNERS AND DRAFTSMEN
November
Monday 2nd
Tuesday 3rd
Wednesday 4th
Thursday 5th
Friday 6th
R. HENRY
D. STROUSE
F. CHECKER
G. ARMIN
G. FITZ
No. 55-45 PRELIMINARY
No. 55-62 REVISE
No. 53-47
No. 56-45 FINAL
No. 55-49 ARCH. ONLY
+16 HOURS
No. 55-29 REVISE
No. 55-44
P
No. 55-29 PIPING
No. 55-62 CONCRETE DESIGN
+36 HOURS
KEY: V-DATE WHEN CHART WAS POSTED
Γ-START DATE
٦-PLANNED FINISH DATE
—-PROGRESS AS OF DATE OF POSTING
NOTES: R. HENRY IS 4 HOURS AHEAD OF SCHEDULE ON 55-47 JOB NO. 55-44 IS 5 HOURS BEHIND SCHEDULE, ON ACCOUNT OF INTERRUPTION FOR 55-29 (SHOWN BY P) FOUR HOURS HAVE BEEN "KILLED" AFTER NO. 55-44 TO PERMIT CHECKER TO CATCH UP. G. ARMIN IS AHEAD OF SCHEDULE ON NO. 55-29 G. FITZ IS EXACTLY ON SCHEDULE.

FIG. 3—SQUAD LEADERS ALSO USE GANTT TYPE CHARTS FOR SCHEDULING ASSIGNMENTS FOR ALL OF THEIR MEN.

PROGRESS RECORD

Project No.	Project Description	Progress Dates - Engineering Work						Appropriation - Construction				
		Rec'd in Eng'r	Eng'r Time Es. Day	Eng'r Asg'nd	Plan'd Start Date	Eng'r Compl. Date	Est Compl. Date	Prep'd	Appl'd	No Asg'nd	Start	Comp.
53-45	Engineering Estimate and Approval required for Light Fixtures in Research & Development Section	10-15										
53-46	Investigational report required for Air Conditioning Switch Gear Building 111	10-15										
53-47	Design new installation of Exhaust Ducts, Forge Shop	10-16										
53-48	Design & check Sprinkler System, Building 45	10-17										

FIG. 4—PROGRESS RECORDS SUPPLY A PERMANENT HISTORY OF EACH JOB.

the history and furnishes a record of the reasons for delays that may have been encountered.

Load Charts

How much work is on hand for each group? When will they be able to take on the next project you send them? Will it be necessary to delay some other project to get the latest "hot" one done on time? Answers to such questions are found on a load chart (Fig. 5). This chart shows the available capacity in man-days of a particular group for each future week, and the load planned for the week.

Light horizontal lines show the percentages of each week's capacity already spoken for by planned orders on hand. A heavy bar shows total load ahead —how long the group would be working to finish work on hand if no new work were received. The jobs and man-hours listed under each month show exactly what work makes up the load. Load lines for several groups may be copied on summary charts, for executive review and department control.

For any consulting firm, there is an optimum load situation — one where your projects aren't delayed too long, but where everybody has a little more than enough work to keep him busy. Once determined, through experience, this optimum load can be used as a gage, and any trends away from it on the load chart will be your signal to act. In a large office it may be advisable to use electric accounting machines for itemizing work loads and preparing reports.

Executive Reports

Effective planning systems also provide executive reports that summarize the situation, assure easy reference to current status of projects, and guide day-by-day executive action. There are various ways of developing these executive reports, but in all cases they must give a complete picture of progress, load, and delays. Preferably, executive reports should be drawn from the active instruments of planning, rather than being a separate staff activity. This increases their practical value and their application by executives.

Results

While various adaptations may be used depending on the particular conditions and the type of work, planning systems should produce the following results:

¶ All projects are completed on or before due dates.

¶ All projects are completed within the budget for engineering man-hours.

¶ The load ahead of each group, and the period in which it falls, is known and is periodically presented in simple graphic form to top executives.

¶ Promise dates for completion of new projects can be determined rapidly.

¶ Delays are foreseen well in advance, rather than appreciated only when due dates are imminent.

¶ Each engineer works on an assignment consistently, rather than being interrupted for "putting out fires."

¶ Engineers remain with the company, rather than resigning because they have not had the opportunity to work at their highest capacity.

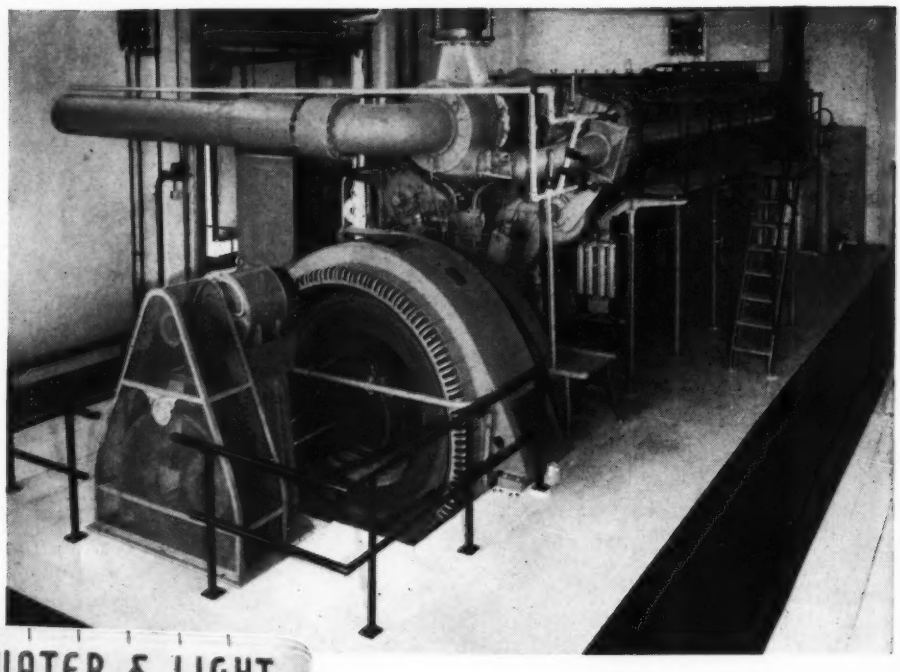
These results will assure maximum value from available engineering talents. ▲▲

LOAD CHART

Design Section	Week of Feb. 26			March 5			March 12			March 19			March 26			April 2		
Available Man Days Per Week	42			47			47			47			47			47		
Load as of Feb 12	THIS WEEK / ACCUMULATIVE																	
	Project	Days This Wk	Days Accu	Project	Days This Wk	Days Accu	Project	Days This Wk	Days Accu	Project	Days This Wk	Days Accu	Project	Days This Wk	Days Accu	Project	Days This Wk	Days Accu
	Fire Pump No. 29	5				5			5									
	Water Supply Rm No. 29	1				5			1			5			5			5
	Switch & Gear No. 12	1																
	Compressor	5				5			3									3
	Add Storage	5																
	Boring Mill	3				1			1									
	Safety Shop	1																
	Master Lift	11				3			2			1			1			1
	Overhead Crane	5																
	Timber Plat	3				4			4			1			1			1
	Paint Shop	2																
		42		Steel Plates	3													
				CP No. 12	4				4									
				Sprinkler	3													
				Exhaust Duct	4				4			4			4			4
				Air Cond.	5				5			5			5			5

FIG. 5—LOAD CHARTS SHOW AVAILABLE WORKING CAPACITY IN MAN-DAYS.

Another Example of Efficient Power at Lower Cost



Above Latest addition to the Brady, Texas, plant — a 3,550 hp supercharged Cooper-Bessemer LSV-16 Gas-Diesel installed in August 1952

BRADY'S GREATEST PUBLIC BENEFACTOR

. . . a Cooper-Bessemer-powered municipal plant

TO say that the home-owned water and light plant at Brady, Texas, is a public benefactor is putting it mildly! Since 1942 this plant has advanced to this city of 7,000 more than $600,000 for civic improvements, *plus* service donations exceeding $200,000. It has helped keep taxes very low while defraying the costs of fire fighting equipment, police protection, street lighting, a new "whiteway" system, power for churches and schools at half cost, road improvements, 20 miles of new pavement and various recreation facilities including a swimming pool.

The Brady plant, like so many other efficient municipal plants, is powered with modern Cooper-Bessemer Gas-Diesels, assuring the highest thermal efficiencies known. Brady's latest is a big 3,550 hp supercharged unit installed in August last year. Because of its high efficiency it is kept in virtually 24-hour operation . . . 5205 hours through March 20, producing 7,325,000 kwh. The remainder of Brady's power is supplied by two older tandem-connected Cooper-Bessemers almost as efficient.

To make the most of your power plans for the future, be sure to check on the distinct advantages you stand to gain with modern Cooper-Bessemers.

MOUNT VERNON, OHIO
COOPER-BESSEMER
GROVE CITY, PENNA.

New York Washington, D.C Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Shreveport St Louis Los Angeles Chicago Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Tulsa Gloucester, Mass. New Orleans, La.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS • HIGH PRESSURE LIQUID PUMPS

Analyzing an Automation Project

C. E. EVANSON, President
T.A.B. Engineers

AUTOMATION IS VERY EASILY ADAPTED TO SOME INDUSTRIES. REFINING IS IDEALLY SUITED.

HELPING A CLIENT determine his need for Automation is one of the most timely services that a consultant can offer. The important question is, " How can you help your client determine his need for Automation?" Before any program can be formulated or any recommendation given, there are a number of factors involving the client, his product, production methods, costs, and capital to be analyzed. It is not enough to say, "Let's Automate." First, we must know whether the client is ready to automate on a practical, economically sound basis.

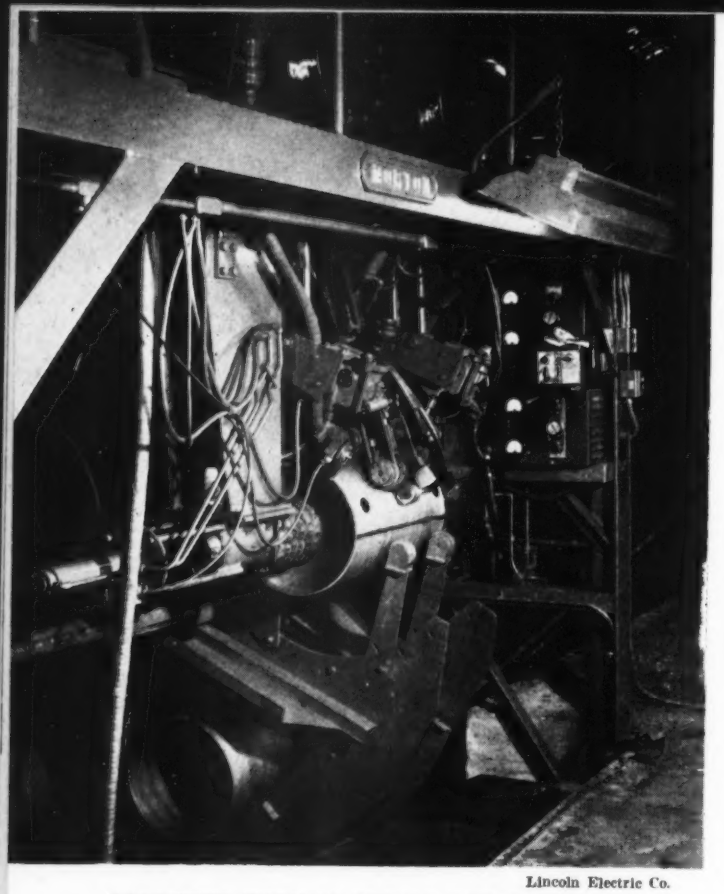
What Are the Client's Plans?

The first significant question to answer is, "Does the company really want automation?" The question could be stated in a slightly different way. "What are the company's objectives for planning and building a strong future?" For the large, Blue Chip companies, with wide and diversified ownership through substantial stock issues, this question is not particularly important. Usually, the large companies are committed to long range planning, but for the medium size or small company, the question of future planning is not always clearly defined. This is particularly true in family enterprises where the immediate or short term operation may be the foremost consideration. For example, sometimes in the family owned business there are no heirs interested in carrying on the organization. Eventually the business will be sold, liquidated, or permitted to regress. Only if the company's owners are seriously interested in long range planning is it worth-while to examine other aspects of the company's operation to find out if and how they can take advantage of automation.

In analyzing the future, it must be recognized that the market for consumer and capital goods is expected to expand in the 1960's. This will be a result of the increase in population forecast for the next twenty years. At the same time there will be new products and substitutes for old products. There will be new needs and desires on the part of the buying public. Therefore, the current trend in customer acceptance of the client's product is significant. It may very well be that a market survey should be conducted to permit analysis of the expected future trend of sales — and, indirectly, profits. But one thing is necessary — there must be a promising future for the product (even though it may have to be redesigned) so that the anticipated sales and earnings will justify the application of automation techniques.

Are Funds Available?

At the same time that the ownership's plans and the product's sales potentials are being studied, the financial health of the organization should also be



Lincoln Electric Co.

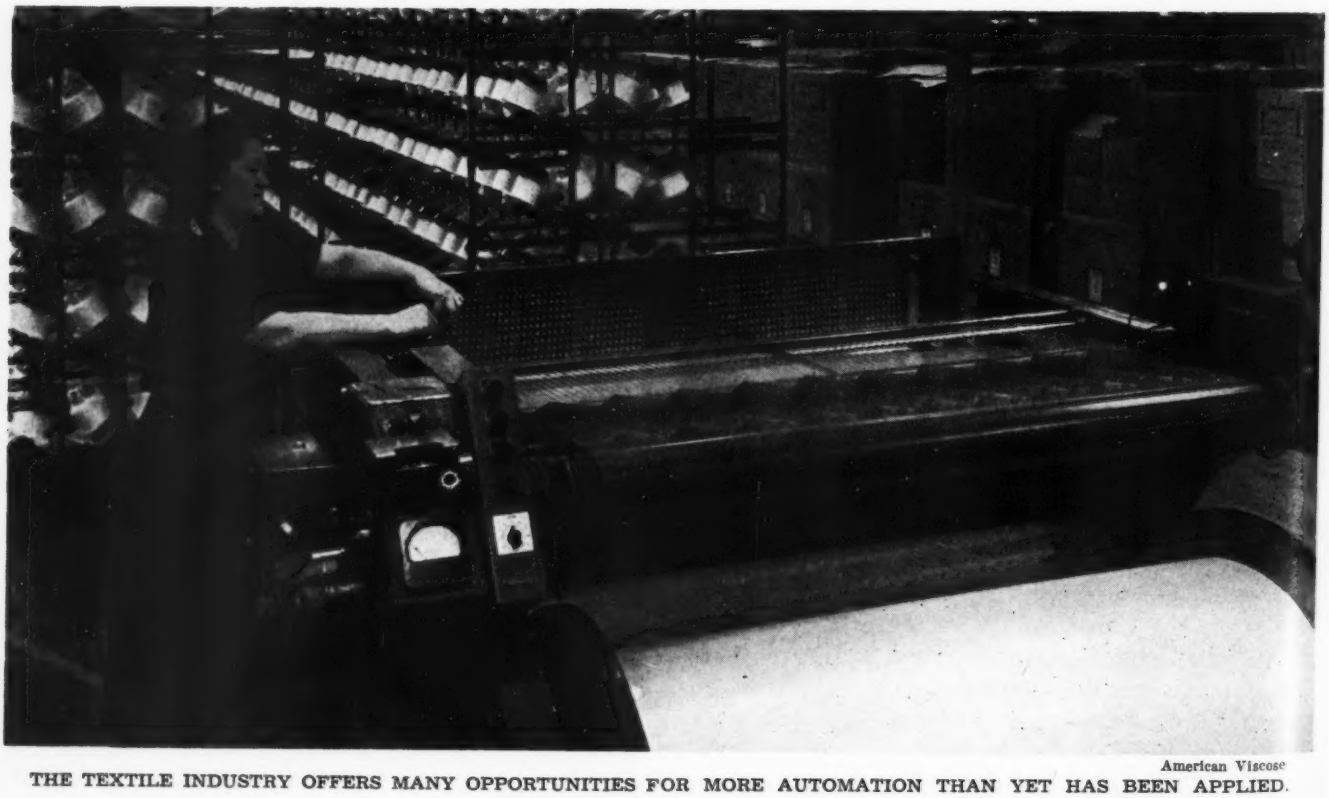
REPETITIVE WORK IN METALS FABRICATING IS ANOTHER OBVIOUS APPLICATION FOR AUTOMATION.

examined. In well-managed companies reserves for research, development, and plant improvements are set aside for future expansion and changes that become desirable. Where this provision has been made, capital — or the obtaining of additional capital — does not present a serious problem. However, the company that is not in a strong financial condition demands a close analysis. In fact, it may be that the reason for their weakened financial condition is high manufacturing costs which have eaten away potential profits and prohibited the building of reserves. In other words, it may be found that while the company may not appear to be able to afford automation, actually automation would be its salvation. In such instances the use of borrowed capital for automation would be justified. This could be in the form of a bond issue or direct loans from financial institutions. Another alternative would be the issuance of additional stock to obtain needed capital from the present owners or outsiders.

What About the Product?

The nature of the product naturally has an influence upon the type of automation production that is possible and practical. If the product is adaptable for continuous processing, the possibilities of applying automation techniques are favorable. A good example of this is the petroleum industry. Here, continuous processing has been applied to great advantage not only for greater sales and profits of the refineries themselves but also for lower prices and better service for the consumers.

Another type of product that is ideal for automation is one suitable for or adaptable to straight-line production. A classic example of this type of product is the automotive industry where automation



American Viscose

THE TEXTILE INDUSTRY OFFERS MANY OPPORTUNITIES FOR MORE AUTOMATION THAN YET HAS BEEN APPLIED.

principles already have been applied with considerable success in many instances.

If the product is not readily adaptable to continuous processing or to straight-line production, then it may be that redesigning the product will be necessary. This may even involve changing the form or shape of the product to permit its being processed by automation. The extent to which product can be redesigned will, however, depend upon market surveys because it is imperative that customer acceptance remain high. The product cannot always be redesigned merely for the convenience of automation production. An example of converting a nonuniform product to a uniform product would be converting tomatoes to tomato juice.

In studying the product perhaps the most important factor to remember is that the basic design (except for minor changes) should remain reasonably constant for at least three years. If the design does remain constant, such as is true in the automotive industry, then automation can be applied to advantage. However, if the design is changed radically each year, then it would be a question as to whether the application of complete automation would be practical. Partial automation might be more applicable and economical.

Is a New Plant Necessary?

The client's present building or buildings probably will be adaptable to automation. Fortunately, in the past fifteen years there has been a tremendous trend toward spacious, one-story industrial structures, which are generally ideal for automation.

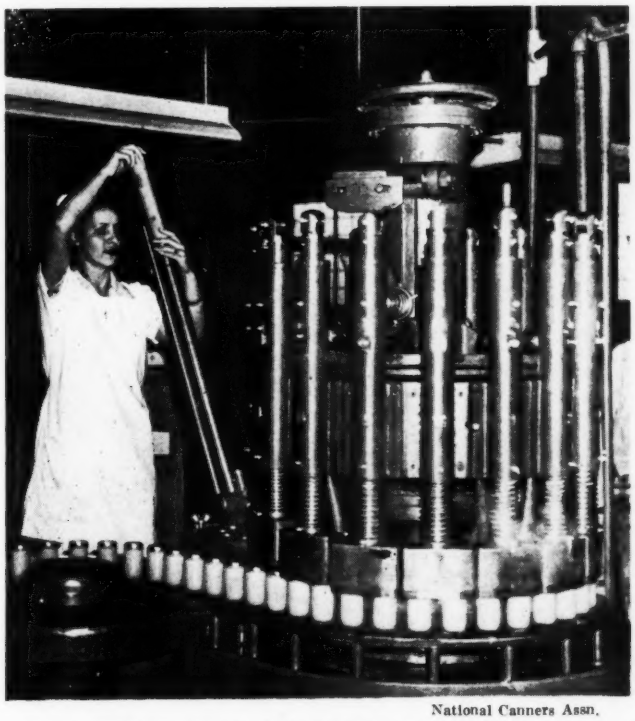
Naturally, if a building is forty or fifty years old, it should have paid for itself and is probably obsolete even for current operations. Therefore, a new structure might be worthy of serious consideration. On the other hand, depending upon the type of product and processing, it may be that the multiple story factory building — whether old or new — could be more adaptable to automation than the one-story building. For example, multiple story structures are ideal for gravity feeds and vertical transfer.

Actually, as a general guide, if a client's plant is not over thirty years old, partial automation, at least, can be considered and probably applied.

Production Facilities and Needs

Production should be fairly stable for at least 70 percent of the time to make automation expenditures worth-while. Certainly, if production consists of a series of short runs, complete automation will not be warranted. However, it should be remembered that even though production runs are limited, a close analysis may reveal that the cost-reducing advantages of partial automation can still be realized.

One of the most significant factors to examine in the production line is the amount of spoilage or the number of rejects. If the client's spoilage costs are high, and if he needs better control over quality, then certainly automation, which helps reduce costs and maintain uniform quality, should be considered.



National Canners Assn.

FOOD PROCESSING IS ONE OF THE AUTOMATION LEADERS. AUTOMATIC CANNING HAS BEEN DONE FOR YEARS.

In analyzing the client's production department, the type and condition of the present equipment and materials handling methods will bear close scrutiny. If there is considerable transfer of materials by hand from one process to another or from and to temporary storage spaces, then the materials handling costs are bound to be high. Further, if the present handling equipment is over fifteen years old, the company is not taking advantage of the rapid strides and development in this field during and following World War II. The new concepts of automation are being applied and will continue to be applied at a rapid rate, so equipment that may seem to have years of life remaining many actually be obsolete and very costly to operate and retain. This does not mean that it will be absolutely necessary to throw out all the old equipment. It does mean, however, that the client should be aware of the fact that even though equipment may seem to have several years of usefulness, it may be costing him more money to operate than if he took advantage of new and improved methods and modern machinery.

Labor's Status

If there is a union in the plant, this must be recognized at the outset, and the attitude of the union leaders must be fully understood. During the current industrial revolution, with increased use of so-called labor saving machinery, our national employment has risen to some 60,000,000. Nevertheless, some peo-

WHEREVER THERE IS EXCESS OF MANUAL HANDLING OR MATERIALS MOVEMENT, AUTOMATION IS A POSSIBLE ANSWER.

ple in unions still feel that automation may result in mass unemployment and, therefore, take a negative attitude toward automation.

Actually, automation will create jobs, eliminate dangerous work, and further increase individual productivity just when it will be needed for our increasing population. When unions and employees understand this, they will realize that while there may be individual or local temporary adjustments, labor will benefit greatly in the end. The attitudes of both the unions and individual workers should be recognized so that the company can adequately explain automation, educate the workers, and prepare them for any program that is to be put into affect.

Another condition to be aware of, as far as labor is concerned, has to do with the type of employee required under automation. New employees will be required to have greater technical know-how and a higher average intelligence, while older employees will have to be trained in the new techniques.

Investigating Production Costs

Probably the most important factor influencing the development of an automation program is that of manufacturing costs. During the past ten years high production costs have been a major problem, and they will continue to plague management. Further, as markets become increasingly competitive, cost analyses and controls will become even more rigid.

For example, where labor cost is high in comparison to material cost, then efforts should be made to reduce labor cost by increasing individual productivity through automation. However, if material cost is higher than labor cost, then the problems are based upon keeping rejects at a minimum, processing more efficiently, and using substitute materials.

Where materials handling costs are high, a study should be made to determine how the movement of the materials in process can be reduced or eliminated. It is in this field that automation has scored some of its greatest gains because the individual transfer of materials from station to station, line to line, and building to building — not to speak of intermittent storage — is very costly. In automation the flow of the product is designed to be continuous, thus eliminating costly materials handling.

Another factor to study is the cost of supervision and inspection and its relation to total labor cost. Where inspection and supervision costs are high, automation can be used to great advantage. The improvements resulting from automation in the final quality of the product naturally reduce intermediate and final inspection costs. Supervision of the production process is also reduced. By reducing direct labor, materials handling, and inspection and supervision costs, the company's profits and competitive position are enhanced considerably.

Conducting the Automation Analysis

How should these factors be analyzed? What methods should be employed? Who should make the automation study?

We have found that there are two steps that should be taken. First, the company should appoint or hire

an "Automation Executive." If an experienced and skillful coordinator is readily available within the ranks of the organization, and if he has the necessary personal and leadership qualifications to handle a staff assignment out of the president's office, then such a man can be appointed to the position. If a man with these qualifications is not available within the organization, then one should be obtained elsewhere. The disadvantage in appointing a man within the organization is that unintentionally his viewpoints and attitudes may not be entirely free of prejudice or individual preferences. On the other hand, a specialist who is brought in from the outside for this permanent position will be more likely to have an impartial viewpoint. The automation executive's staff need not be large but could consist of one assistant plus a one or two unit clerical staff.

Using the Specialist

Next, the consulting engineer should — through the cooperation of the automation executive — begin the studies to analyze the various factors discussed. If the consultant retained is a general practitioner, he should not be expected to handle every phase of an automation analysis. Instead he should consult with other consultants, and he should draw upon the knowledge and experience of automation specialists. In fact, the general consultant owes it to his clients to take advantage of the best automation information available to serve his clients best interests. The idea of cooperation between an individual or general consultant and an automation consulting firm is not new. In fact, such cooperation assures the client of thoroughness and completeness.

Further, the consultant has another responsibility. He must see to it that all activities are coordinated. For example, the architect who designs a new factory should be aware of automation and how it might affect the ultimate building design. The product designer must be sure that his design will meet the requirements of any automation program the client may be considering for the future. If replacement or improvement of an old process is being considered, the process engineer should understand the subject of automation and see how it might be applied.

Conclusion

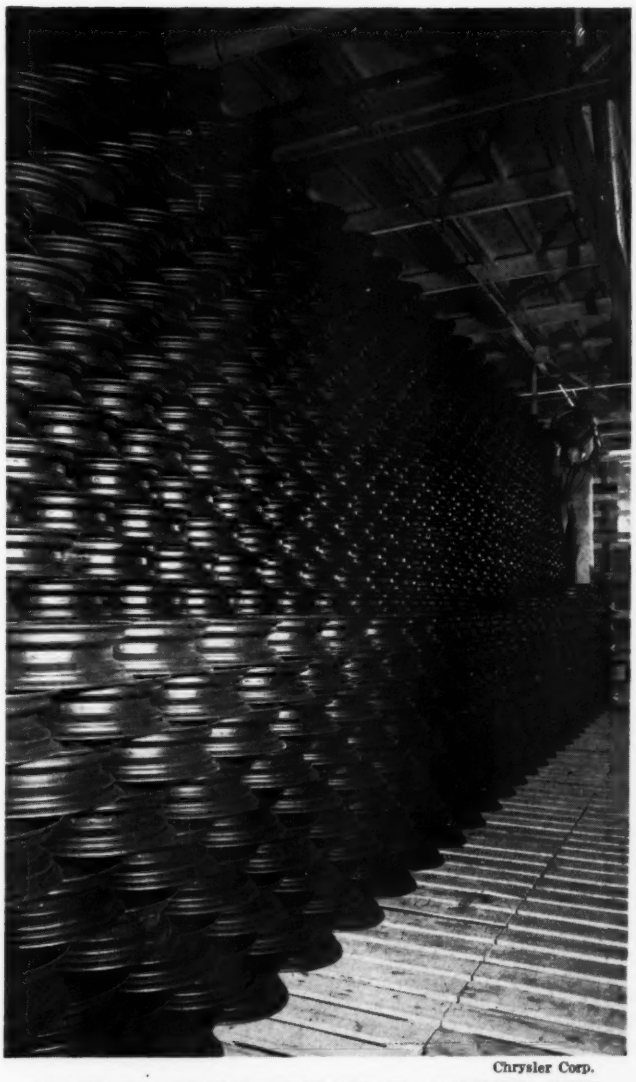
Because of the rapid developments taking place in automation technology, it is not too early for your clients to start planning right now for the future. Automation is not an overnight program — it is a long range project. Companies undertaking automation must think and plan five or more years ahead.

Consultants must have the vision and knowledge to help their clients take advantage of this new manufacturing concept.

Therefore, if your client is purchasing or building new equipment, or if your client is building or planning to build new factory space, and automation is not in the plans or an automation appraisal has not been made, he will not be getting the most for his dollars. That is why consultants must help their clients keep their eyes on the future — and recognize the trends of uphill costs coupled with greater markets and higher production requirements. We must remind our clients that automation will help them beat those rising costs and will increase production in several important ways.

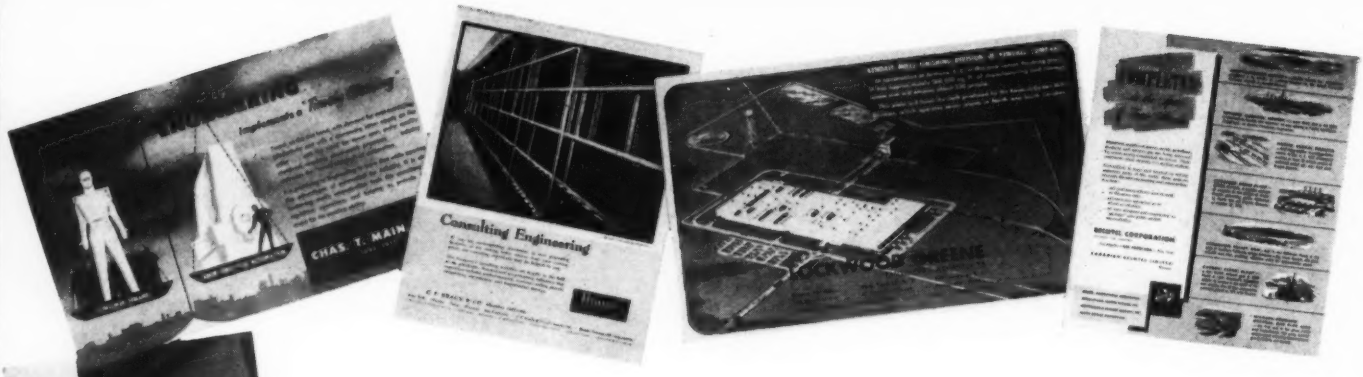
¶ Increased output per worker.
¶ High quality and less wastage.
¶ Greater product uniformity.
¶ Better working conditions.
¶ Greater sales demand.
¶ More efficient use of materials and manpower.

Finally, it is the responsibility of consultants to help their clients determine how they can take advantage of automation. As we have seen, this will require a competent, professional automation appraisal of every phase of the operations — both technical and economic. ▲▲



Chrysler Corp.

LARGE IN-PROCESS STORAGE IS ANOTHER SIGN THAT AUTOMATION MIGHT WELL PAY DIVIDENDS.



"Yes," is this author's answer to the question . . .

Should Consulting Engineers Advertise?

Cp exclusive

RICHARD L. MOORE
Foster D. Snell, Inc.

Advertising, by consulting engineers, presents a serious problem in professional ethics. The "Canons of Ethics for Engineers" states, "He will not advertise his work or merit in a self-laudatory manner . . ." The question here is, "What is meant by 'self-laudatory.'" What some may feel is modest and conservative, others might consider bragging and flamboyant.

While most engineers seem to think that they should let the business come to them, there is a growing group who feel that they should go get the business. The author of this article feels that we must go after it with advertising. He puts up a strong argument, and he has many reputable engineering firms on his side. Most of the firms doing both engineering and construction do advertise, but, also, a few excellent, highly respected firms who do only consulting work advertise widely.

This problem will not be solved by ignoring it. This article gives one side only. In later months we will publish articles by authors who oppose advertising by consulting engineers.

THE MAJORITY of consulting engineers do not exploit advertising and promotion methods to increase their business because they feel it is unethical or undignified for a consultant to advertise —or they are indifferent to advertising. However, the consultant differs from the other professional groups who shun advertising, and I would like to show why the engineer should advertise and show some of the methods that he can employ in using advertising, promotion, and public relations.

Who Is a Consultant?

A consulting engineer renders service to the public, industry, and government. This service is based on his educational training, experience, and technical knowledge. His services are usually available for a fee. In essence, the consulting engineer resembles a specialized employee who is not on a fixed payroll and who serves several employers.

Most consultants were first employees, who developed specialized skills, and then either joined or formed a consulting organization rather than continue as employees. A consultant may also be a college professor offering services on a part-time basis or a technical man who has reached retirement age and has decided to offer his background where it is needed. The paths to consulting are almost as numerous as the reasons for leaving an employer.

Why Is Our Profession Different?

Let us compare professional engineering consultants to the other professions who shun advertising and publicity. We know that a doctor opens an office after he leaves his internship. We also know

that as he becomes established in his community, he builds up his following among his neighbors. If he is a pediatrician, any child living in a thirty to forty mile radius is a potential patient. If he settles in a thickly populated area, he may have more patients than he can handle.

This general condition exists not only for doctors, but for dentists, veterinarians, accountants, and even lawyers. Most of their clients live within a range of fifty miles. And sometimes within this range of fifty miles there are hundreds of thousands of potential clients. These professional men have no real need for advertising. If they wish to become better known, they can join civic groups, can devote themselves to clinical work, can give lectures and deliver papers on results of their work. Yet the social and business mores compare the consulting engineer to these other groups, which from the outset seems unreasonable. The only true comparison should be that of equal professional rank. The shortage of doctors keeps every waiting room bulging, but how many local people regularly need a firm of consultants who can supervise the planning and construction of an ethyl alcohol plant. In fact how many would even know where to find such a firm if they should need consulting services? The consultant's business cannot be built around one particular geographical area. The consultant cannot expect neighbors to tell friends and friends to tell others about him, as can the local doctor.

There is another major difference. If the consultant has an engineering project on hand that will require about two years of steady work for twenty extra people, he will have to rent larger space and hire the additional staff. After fifteen to twenty months work on the project, he must look around him and survey the domain that he has established. Probably the first question to strike his mind is, "What am I going to do with these extra employees after this contract is over? The work is progressing satisfactorily and will close as expected. Will I have to let these men go for want of work?"

Let me bring that problem a little bit closer to home. A chemical engineer from a large manufacturing plant in the metropolitan area told me that one of his competitors is giving up the hiring of engineering consultants and is planning to set up its own chemical engineering offices and laboratories. This large company now is spending more than $100,000 annually for outside consulting services, and many consultants will be affected by their decision. Suppose this manufacturer represents the basic client for a small organization of engineers. What are they going to do about their future?

Volume Problems

Whether you are selling only the services of yourself, or of ten men, or of a thousand men, you are faced with the problem of bringing in a certain volume of business to keep busy. How do you go about this? How do you plan your own security? A steady volume of business today does not prepare for tomorrow. For example, the professional advertising agencies have problems similar to engineering consultants. Last year, in Philadelphia, there was an advertising agency that had slightly over $11,000,000 worth of business. They were a fairly large agency. They paid good salaries and had good people. Their billings had been going up for close to twenty years. Then one day a company, in Camden, N. J., across the river, cancelled its account. That account was the Campbell Soup Company, and their billings were about $11,000,000. Obviously the advertising agency had put all of its eggs into one basket, and the upshot of it was that that agency could not carry its other small accounts, and it ceased to exist when the large contract expired.

If we sit back and become lethargic and let our business come in over the transom, we, too, may fold sooner or later. How many of us know of established consulting organizations that went out of business almost immediately after their owner or founder became inactive.

To sum up, the consultant is a professional man, but he must advertise to maintain his business and to expand it.

Many individual consultants whom I have known have earnings far in excess of earnings they would

have if they were on someone else's payroll. But others have found the going very tough. This, in my opinion, is because they do not know their potential clients, nor do the clients know them.

A Problem of Education

Technical consulting services are unknown to many business people. We are accustomed to hearing a new client say, "If I had only realized before that there were such people as consultants, how easy it would have been for my organization to have solved that problem." What this means is that the consultant, unlike the doctor of medicine or the lawyer or the accountant, has a tremendous job of education to do. If more people understood how to use a consultant and hired one when they had a problem, the economic status of consultants would be enhanced, and the clients would be better off.

Recently my attention was called to an article in *Printers' Ink*, by J. K. MacNeill, called "Should Professionals Advertise." The article is so close to my point that I will quote from it.

"I happen to be sales manager of a manufacturing firm that sells materials to the dentist. As long as I can remember, the dentist has complained that the public does not utilize the available dental service enough. I don't have the figures at hand, but I am under the impression that the U. S. spends more money on dog food than it does on its oral health. Dentists as a group would like to change that. The public would enjoy better health if it were changed. How are you going to change it?

"I believe that the answer to the dentists' problem can be applied to the other professions. The dentists' problem is to sell more dentistry—not in competition with themselves, but in competition with all other industries and services that fight for the public's dollar. The only known way to accomplish that is by group action. Instead of Dr. Jones advertising that he makes a better inlay than his colleagues, let dentistry advertise itself to the public.

"Dental advertising can sell dentistry. It can remove forever the archaic pain bugaboo by well prepared copy on modern anesthesia. It can condition the mind for the full denture with psychology in print. Easiest of all, it can sell the social and business significance of good teeth and good-appearing teeth. And most important, it would be in the public interest."

Mr. MacNeill's point on dentists extolling the virtues of dentistry could apply to consultants as well. A diversified organization of engineers is analogous to any group of professional individuals who have joined hands under one roof. They should be able to tell why you should use consultants and mention some of the variety of services they offer.

Where Does Our Business Come From?

Generally, consulting business comes in as a result of the recommendations of others. The better known you are, the more people there are who will have you in mind the next time a prospective client asks a friend of yours where he can get something done. Business also comes in from the industrial directories such as the trade directories and the telephone red books. And sometimes the care in wording and the prominence of the advertising box causes your telephone number to be the one selected. How do you select a firm from a telephone directory? It is usually based upon appearance and appeal of the ad.

Business comes in from the letters you have written acquainting others with your services. A company may receive your letter and have no use for your services, but someday they might tell a friend, if you remind them often enough.

New business is based on the impression or impact created on the mind of the firm looking for outside services. When the proposals of two firms are examined in a competitive basis by a possible buyer of services, the better known organization of the two stands the better chance of getting the nod. Of course, the consultant's presentation, background, experience, and cost estimates may have a great deal of influence, but the all encompassing word, "prestige" may be the deciding factor.

Professional Listings

Most consultants cannot "sell" in the usual sense of that word. They do not generally select a prospective client and bombard him by the doorbell ringing technique. However, they can sell by institutional advertising. In the Business section of the *New York Times* there are two or three dignified professional cards of consulting engineers. There is no address or telephone number, yet the repetition of the ad, day after day, year after year makes these engineering firms the best known group to the public they attempt to reach. This is not unethical, merely good common sense.

A consultant can stay small by lack of promotion, or he can grow large with the proper use of it. Perhaps it would be wise to reflect a moment on just what his objectives are. If he has a certain amount of security in the accounts he serves, and he feels that his income is adequate, why should he bother? If a man has a lucrative automobile business in a small town, why should he branch out into two or three other towns? The government is not going to help him make much more after taxes, anyway. About the only reason for expanding or promoting the business, then, is to maintain the status quo and to guard against hard times or aggressive competition. At Snell our business has been on a gradual climb over a thirty-five year period. After the war, we had a staff of seventy, and our management felt that in order to maintain our position we would have to become more sales minded. We started to use display advertising in 1948, along with a greater emphasis on other promotional tools. Our gross volume has increased at

"NO, I HAVE NEVER FELT IT WAS ETHICAL TO ADVERTISE."

a rate of 15-20 percent per year ever since this program's inception, which means that while we have added to the complexities of running an organization, advertising has been not only the provider of our objective, a maintained status quo, but has added a protective blanket of increased volume.

The advantages of a steady flow of business are legion. For example, it offers the opportunity to shift personnel internally when one department lags momentarily. This means job security, and in a service organization where personnel are the most important commodity, this is one of the strongest assets you can have.

Promotional Suggestions

What are the means that we can use ethically to amplify our voice and tell about our services. If we are specialists in catalytic hydrogenation plants, we ought to send letters to industries interested in using this specific service. This is known as direct mail advertising, and it is a very potent form of advertising for the consultant. We ought to join organizations and mingle with the technical people of the industry engaged in catalytic hydrogenation processes. We ought to give papers publishing the results of our experiences in this field. Copies of these papers should be sent to interested parties. If we are specialists in catalytic hydrogenation, we know who should receive the papers. Sometimes, of course, we do not. Therefore, we should spend a few dollars and buy advertising space in the trade journals that reach those interested in this type of work. We might put out a monthly bulletin on "What's new in CH" and send it around to all those interested. This sets us up as an expert, establishes our reputation, and reaches our market day after day, month after month.

Advertising and promotion should not be of the one shot type or of a sporadic nature. By that I mean you cannot suddenly flood the market with some paid professional advertising, a pamphlet, a booklet, a house organ, or a speech. No, this has to be a regular, continuous effort, and you cannot expect results by a sudden surge of such promotion. Sometimes we have found that a certain promotion piece or an advertisement paid off two or three years after it was mailed or published. Furthermore, you cannot expect any one form of advertising to be the entire answer. You must use them all, and tailor the ones best suited to you into a well integrated program.

It is true that there are many forms of advertising and promotion, and a small organization or an individual consulting engineer may feel that he has neither the time nor the money to spend on trying to develop business in this way. It's true that various forms of advertising and promotion cost money. You can spend tens of thousands of dollars a year on this. But do not use the excuse that you do not have the time. You will have plenty of time for it if you have no business coming in.

A little effort on a daily basis, even if it is only thirty minutes, may provide enough to enable you to build something that will furnish you with more income and more capital for expansion.

Here is a simple promotion program to help you.

¶ Develop a mailing list.

¶ Send this list news on new developments about unclassified projects, your background experience, and your capabilities.

¶ Write press release material on what is new in your organization. Personnel changes can be one item, but new developments or thoughts you have concerning some aspect of your field are much more provocative.

¶ Send these releases to trade journals in your fields.

¶ Get together with a group of consulting engineers and pool your advertising dollars. This would be very appropriate if you offer services that complement those of your fellow consultants. While a third to a half page of space in a technical publication may cost $250, when five consultants buy it, it only costs $50 apiece for the ad.

I cannot overemphasize the value of making your public aware that you exist. In this day of merger and consolidation, the consultant has a much harder fight to reach his market unless he organizes and emulates the tactics of business, which spends billions annually on all forms of advertising, promotion, and public relations. All of us should try to use every resource at our disposal to educate and arouse awareness of the value of using consultants. The more interest we create through advertising the greater the demand of our services. ▲▲

REPORT FROM HOLLAND

FRITZ D. HIRSCHFELD
European Editor

THE SWEDES are an enterprising people and have been responsible for many new technical innovations. Their pioneer work in high voltage (400 kv) power transmission is one of the developments being closely followed by American power companies and consulting engineers. The American Gas and Electric Co., under Philip Sporn, is conducting extensive experiments on 400 kv distribution systems in the U. S.—a good part of this work being based on the practical experience provided by the Swedish high tension networks. And in Europe, where plans are being made to link the countries lying between Yugoslavia, Spain, and Sweden in a common power distribution net, the Swedish 400 kv designs will probably form the basis of this future hook-up.

The Swedes also have been experimenters in new political and social ideas. State-owned industries effectively and efficiently compete with private business on an equal basis. Cooperatives—from housing projects to retail food stores—flourish. Even labor and management accept the State as an equal at the bargaining table. The syndicated columnist and author, Marquis Childs, in his popularized book, "Sweden—The Middle Way," has pointed out how well this remarkable partnership of socialism and capitalism has worked in practice.

These unique amalgamations of social, political, and economic ideas have also had an effect on the development of technical enterprises. For example, the power supply in Sweden (95 percent of which is hydro) is administered by the State, by the municipal authorities, and by a number of private companies. The State is responsible for generating 40 percent of the total energy production. It distributes power directly over an extended network to such big consumers as the railways and large industrial concerns as well as to the municipal works and distributing associations for retail distribution. The municipal authorities are responsible for 5 percent of the total power production. Private companies, some with municipal bodies as shareholders, generate the remaining 55 percent. About 20 percent is generated by industrial firms, mainly for their own requirements; the other 35 percent of the total power production is supplied by power companies independent of the state.

Practically all power stations in the country are operated in parallel to facilitate the interchange of power. There is a large scale exchange of power to economically balance consumer requirements against available production facilities in accordance with schedules drawn up each week by the managements of the State, municipal, and private power companies. The joint operation is controlled through the Central Operating Management (CDL) which was established by voluntary agreement of the State Power Administration with eight municipal and private companies. The country is divided into thirteen sections, eight of which are under control of the municipal and private concerns, the other five are under the corresponding local power administrations of the State. Each section is under an operating management responsible for making local decisions. The financial accounts in connection with the exchange of power are settled directly between the concerns involved, a system that has been found to work very satisfactorily.

The State power stations and distribution systems are designed by the engineers of the State Power Board who also supervise the construction work carried out under their own administration. The municipal and private power companies generally plan and build their installations with the assistance of consulting engineers. That means that private consulting engineers can compete for roughly 60 percent of the total power business in Sweden, the other 40 percent belonging to the State Power Board.

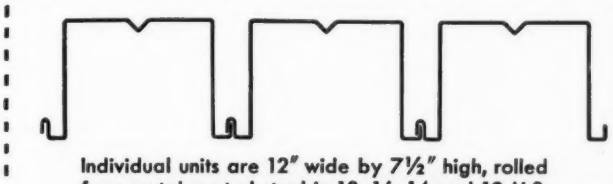
As far as engineering developments are concerned, the State Power Board and consulting engineers are in competition with each another to devise improved designs and techniques. However, this competition does not apply to the problems of high-tension power transmission in Sweden. About twenty years ago, a law was passed forbidding any private firms from transmitting power at over 200 kv. Therefore, practically all the work with high-tension 400 kv distribution has been done by the State

Now Span 32 Feet

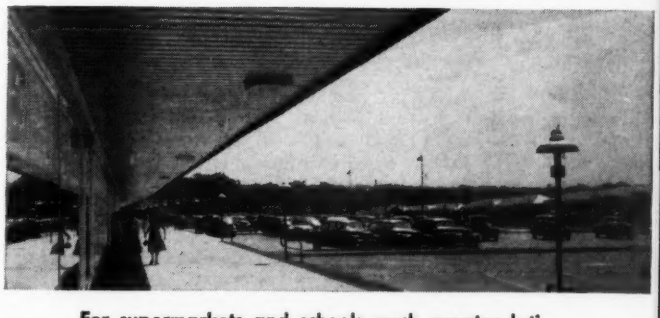
with Robertson Long-Span Q-Deck

LIGHT WEIGHT • GREAT STRENGTH • EASY TO INSTALL • GOOD LOOKING

After considerable testing and research, H. H. Robertson Company is pleased to announce the availability of a new product much needed in modern construction—a steel deck that will span great distances with the required load-carrying capacity. This new *Long-Span Q-Deck*, now in production, carries with it all the basic qualities and advantages of Robertson's well known Standard Q-Deck. Tight side laps become standing seams and are caulked and mechanically fastened at regular intervals to act as a vapor barrier and for structural stability. Units are easy to handle and erect with a minimum crew. They install quickly and tightly because of precision manufacture. *Long-Span Q-Deck* fills a long felt need in schools, supermarkets and other buildings where longer single spans bring construction economies and design flexibility. Any standard insulation and built-up water-proofing can be used. Use the coupon to write for technical literature about this new Robertson product.



Individual units are 12″ wide by 7½″ high, rolled from metal-coated steel in 18, 16, 14 and 12 U.S. Gage. Standard lengths up to 32 feet maximum.



For supermarkets and schools much greater latitude of design is allowed by increasing deck span. Considerable saving in structural steel is made possible, and time and labor are cut down in the erection of the deck itself.

H. H. Robertson Company

2431 Farmers Bank Building • Pittsburgh 22, Pa.

In Canada: Robertson-Irwin Ltd., Hamilton, Ontario

In England: Robertson Thain Ltd., Ellesmere Port, Cheshire

Offices in All Principal Cities — World-Wide Building Service

Please send free information on Long-Span Q-Deck.

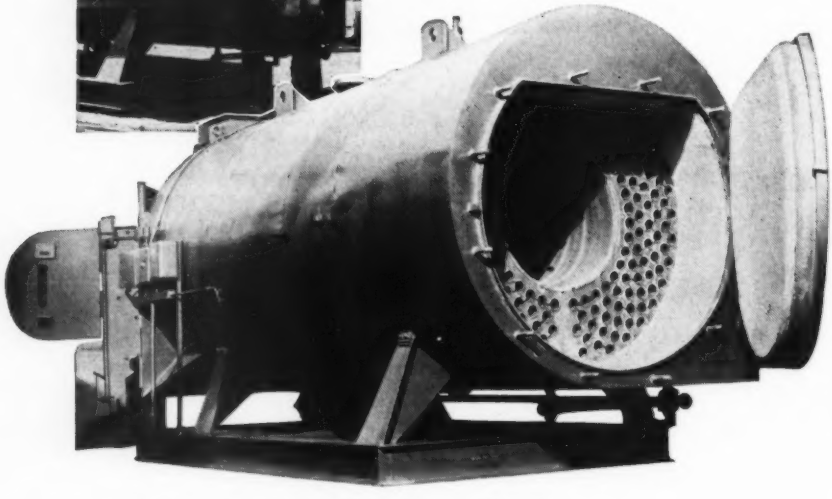
NAME _____ TITLE _____

FIRM _____

ADDRESS _____ CITY _____

ACCESSIBILITY

is built into the
Continental
BOILER



. . . saves production time
. . . saves maintenance dollars

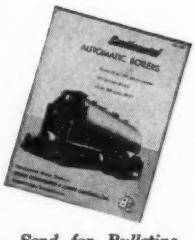
Rugged, simple in design, accessible—that's the Continental Automatic Boiler. Here are a few reasons why it's easy to keep this packaged steam generator at peak efficiency:

- Openings are provided to facilitate inspection of steam and water space.
- Both front and rear doors are hinged—affording quick access to furnace and return tubes.
- Cleaning, when necessary, is easy. One man can open both doors in a matter of minutes.

AND HERE'S WHY CONTINENTAL BOILERS STAY EFFICIENT FOR A LONG TIME:

- 2-pass design eliminates refractory baffles in front and rear which may burn out, leak and cause short circuit of gases.
- *All* return tubes are subjected to the same temperature and do equal work . . . and there is more uniform longitudinal expansion of the pressure vessel.

Used for high or low pressure steam and for hot water applications, Continental Boilers are fully automatic, range from 20 to 500 hp. and can be gas, oil or combination fired. Over 80% efficiency is guaranteed.



Send for Bulletins BE3-4 . . . and let us bid on the next boiler you need.

Continental
AUTOMATIC BOILERS

BOILER ENGINEERING
and Supply Company, Inc.

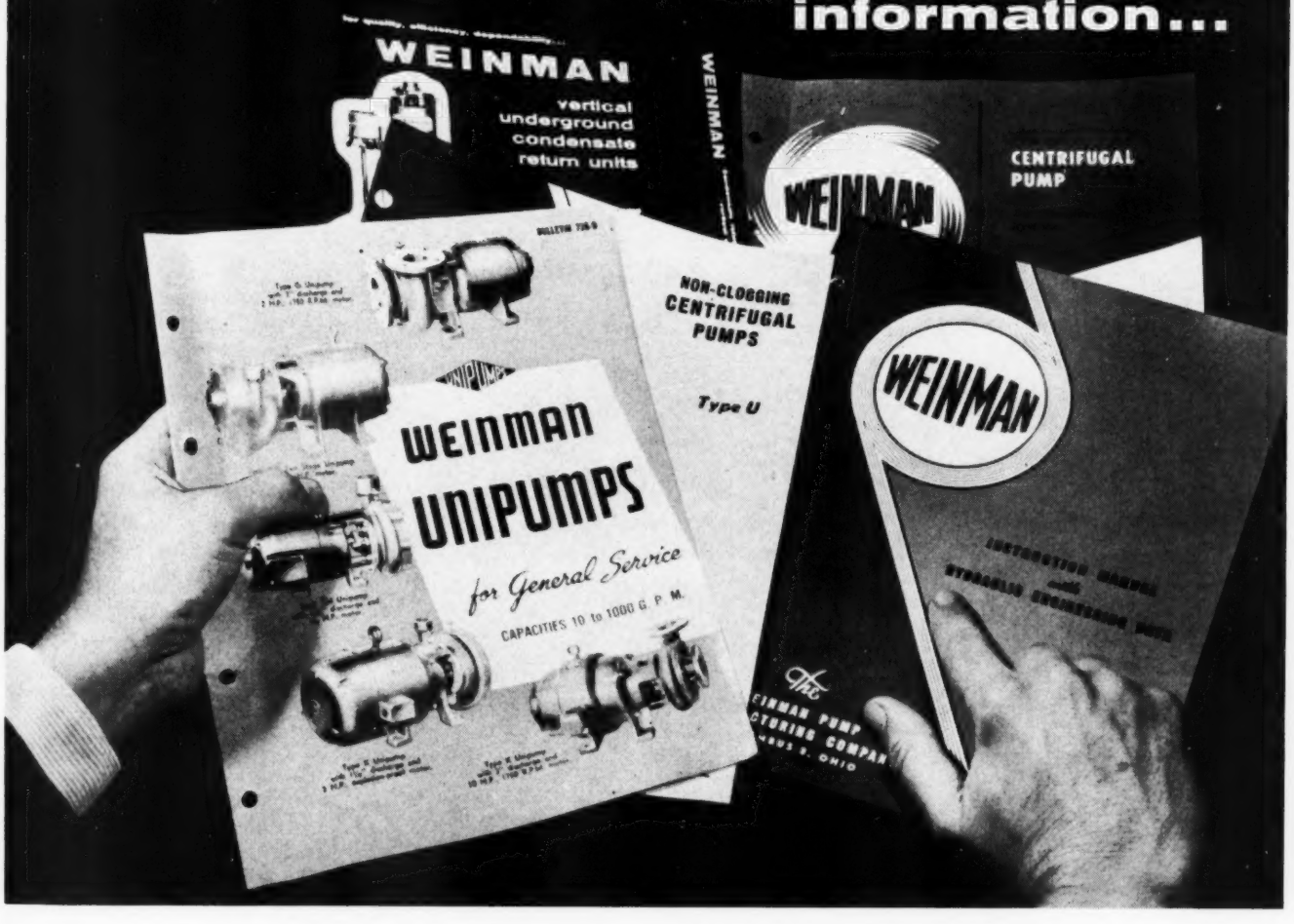
1 Manavon Street
Phoenixville, Pa. Phone 5832

Power Board. When I spoke with Mr. Bo Rathsman, Vice-President of the Power Board, he expressed the opinion that it would have been better to have allowed private consultants to engage in this field since the competition undoubtedly would have encouraged advances and stimulated new developments. When the original law was passed the hazards inherent to 400 kv transmission were not defined, and this may have justified protecting the public interest by placing the experimental work under a State monopoly. Today, those reasons are no longer valid, and the law may now be modified to allow consultants and private interests in Sweden also to engage in this promising field.

Among the Swedish consultants, the most prominent firm is the Vattenbyggnadsbyran (VBB) group of consulting engineers and architects in Stockholm. VBB has been the consultant for nearly all the hydroelectric installations in Sweden undertaken by private interests. The firm employs about 120 graduate engineers and architects, which makes it by far the largest consulting firm in the country. One of its Senior Partners, Mr. Valter Furuskog, is President of the Swedish Association of Consulting Engineers, and approximately 34 of his colleagues at VBB who work mainly with hydroelectric development, water supply, sewage treatment, and town planning, are also members of the Association. VBB has been very active abroad. Before 1939, it designed extensive power installations for Russia and some of the neighboring Baltic states. In 1953, VBB was appointed consulting engineer to the Egyptian Government for the civil engineering work on the Aswan Dam Hyrdoelectric Scheme (capacity 368,000 kw) now under construction in Egypt.

The Swedish Association has 92 members. Mr. Furuskog (my host in Stockholm) told me that this includes all the more important

Be able to put your hands on the right pump information...



for Sewage and Water Service

Perhaps you have a place for a dependable WEINMAN pump unit, *right now*—or are considering future applications. If so, you'll want these NEW WEINMAN bulletins to aid you in determining the BEST type of pump for the job you want to do.

From impeller to shaft seal, WEINMAN pumps are built better — for WEINMAN quality is *built-in!* That built-in quality adds up to dependable pumping efficiency for every job in your field — with WEINMAN.

Let a Weinman Centrifugal Pump Specialist help you solve YOUR pumping problems

No matter where you are, there's a qualified WEINMAN Centrifugal Pump Specialist who will gladly lend you a helping hand. See your telephone book yellow pages — or write for name of nearest representative.

THE WEINMAN PUMP MFG. CO.

SEND FOR BULLETINS NOW!

Send me these bulletins

- ☐ Instruction Manual with Hydraulic Engineering Data
- ☐ **W-11** Condensate Return Unit to 40,000 EDR
- ☐ **726-D** Close Coupled Unipumps for General Service
- ☐ **730-C** Non-Clogging Centrifugal Pumps

NAME

ADDRESS

CITY STATE

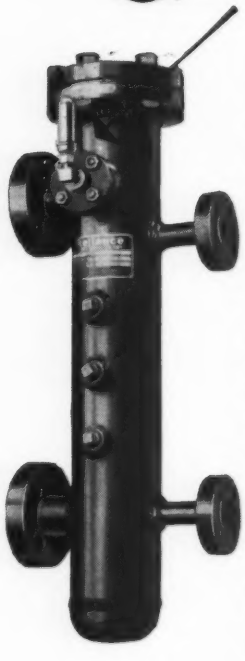
The Reliance Safety Team

Warns you of low or high boiler water

Prevents many a water level accident

SOUND CHECK ✓ ALARM Water Column

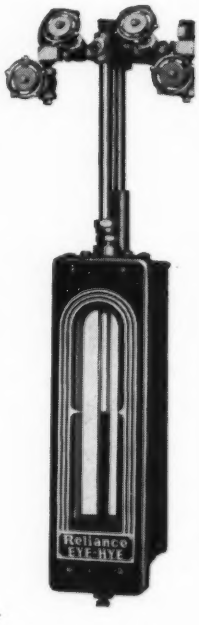
SIGHT CHECK ✓ EYE-HYE Remote Gage



It takes *Team Work* to prevent boiler accidents. No amount of *equipment* entirely offsets factors such as ignorance, carelessness and indifference on the part of operators.

It takes team work between men and devices to keep your plant safe. If your men can *hear* and *see*, their attention to the water level information supplied by the Reliance Safety Team will prevent boiler water level accidents.

The sensitive float-operated Alarm on the Reliance Water Column sounds a last-resort warning when water approaches low or high danger points. But for minute-to-minute scanning by operators, EYE-HYE beams its bright picture of true water level condition from its convenient eye-level position.



Avoid time-and-money-expensive low water accidents with the help of the Reliance Safety Team. Ask your nearest Reliance Representative, or write to the factory.

THE RELIANCE GAUGE COLUMN COMPANY
5902 Carnegie Avenue • Cleveland 3, Ohio

The name that introduced safety water columns....in 1884

Reliance®

BOILER SAFETY DEVICES

consultants in Sweden. However, from other sources I understand that a number of Swedish consultants have been reluctant to join the Association because they feel that the Association—with over a third of its membership represented by VBB men—is too heavily weighted to give these smaller firms much voice. The criticism may or may not be valid, but it does present an interesting problem.

Back in 1897, Professor Gust Richert, of the Technical University of Stockholm, founded the consulting firm of VBB. His colleagues at that time were some of his own students. As they progressed in the new firm, Professor Richert gave each of them an opportunity to participate in the ownership and management. It was his idea that the active engineers in the company should always be in control of the management and policies of the firm and should share in the profits. The system, with modifications prevails today.

The company has outstanding 400 "A" shares and 1,200 "B" shares with the same nominal value. Every proficient engineer, after he has been with the firm for 10 years, is allowed to buy "A" shares. An agreed practical limitation is that no individual is permitted to acquire more than 10 percent of the outstanding "A" shares. A further limitation is that at the company meetings, none can vote more than 20 percent of the votes represented at the meeting. Each "A" share entitles the holder to one vote in electing the Board Members. The Board Members determine policies and elect a Managing Director who heads the firm. Although the Managing Director is elected annually, he generally retains his office until retirement.

At the age of 65, retirement becomes compulsory. The "A" share holdings must be sold back to the company at that time, or they can be traded for an equal number of "B" shares. The "B" shares re-

Testing Noise Levels

SORGEL transformers are known and chosen for their quiet operation, because their noise level is well below the established standards.

Because of their quiet operation, SORGEL transformers are particularly adaptable for indoor installations —in hospitals, schools, institutions, libraries, office buildings, stores, and other structures where low noise levels are an important factor.

Our new testing laboratory, with modern, complete testing equipment and facilities, enables us to know what the efficiency, noise level, temperature rise, and performance of SORGEL transformers are before the installation is made.

The liberal design of SORGEL transformers also results in high efficiency, long life, and a liberal overload capacity for emergencies.

SORGEL transformers are available in a large variety of sizes and types for every purpose. ¼ Kva to 2500 Kva single phase. 1 Kva to 3000 Kva 3-phase. All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts, and any intermediate or special lower voltages.

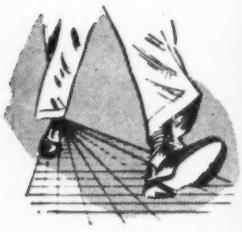
SORGEL dry-type or Askarel-cooled transformers are also incorporated in substations. Available with any type or make of switchgear, or from any substation manufacturer.

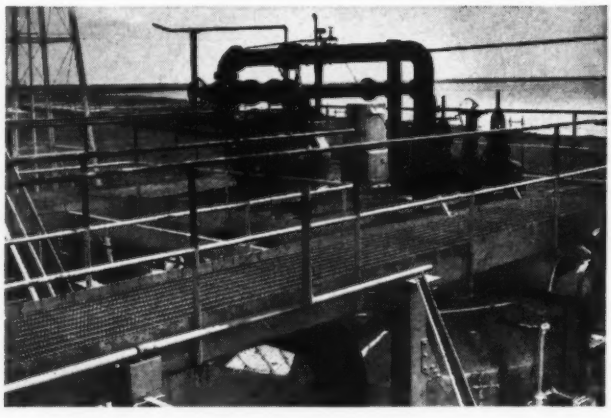
Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 843 West National Ave., Milwaukee 4, Wis.

40 years' experience in the development, manufacturing and application of transformers.

WHERE SURE FOOTEDNESS COUNTS

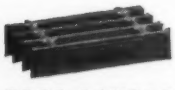




Gary

STEEL GRATING MAKES WALKS SAFER

Sturdy, one-piece construction with tops of all bars flush provides open steel flooring and stairs for safe, easier walking. Gary Grating is furnished in a wide variety of neat appearing designs and sizes—and is tailor-made to fit your needs. For complete description and installation pictures on Gary Welded Grating, Stair Treads and Gary-Irving Decking, ask for Catalog CE-115

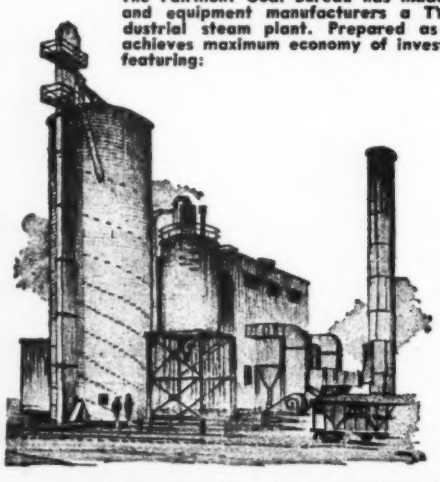


FREE SAMPLE
We'll send this handy paper weight if you request it on your company stationery.

Standard Steel Spring Division
ROCKWELL SPRING AND AXLE CO.
4015 East Seventh Avenue • Gary, Indiana

Modern Design *for the* MODERN COAL

The Fairmont Coal Bureau has made available to consulting engineers and equipment manufacturers a TYPICAL DESIGN for the small industrial steam plant. Prepared as a guide to good engineering it achieves maximum economy of investment and engineering costs, while featuring:



- Fuel flexibility
- High efficiency
- Low fuel costs
- Minimum labor requirements
- Cleanliness, Automaticity, Reliability

Fairmont Pittsburgh Seam Coal is the MODERN COAL. Enormous reserves and inherently favorable mining conditions guarantee ample supply and low production cost. Modern mining and preparation facilities assure uniform quality.

Fairmont Coal Bureau engineers are freely available to help you solve fuel and combustion problems. Write for Technical Reference Bulletins and other valuable publications.

FAIRMONT COAL BUREAU
Dept. CE, 122 East 42nd St., New York 17, N. Y.

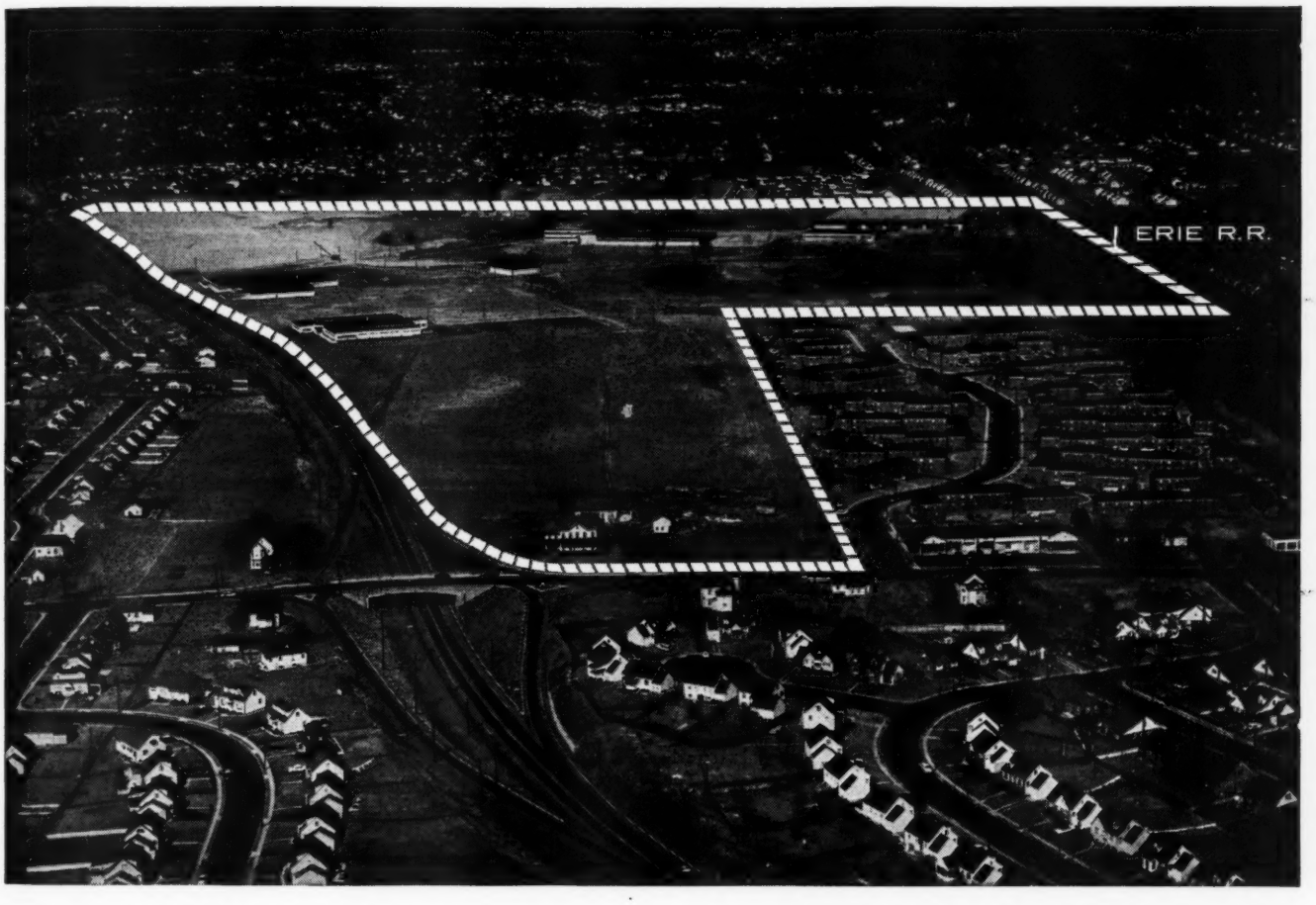
ceive the same dividends (averaging about 7 percent for the last few years) as "A" shares but they entitle the retired member to only 1/100ths of a vote for each share held. These "B" shares can be passed on to the member's children but in the next generation must be sold to the company.

This system gives all the engineers an active voice in the management of the company as well as the incentive that comes with being able to share in the profits; it does not permit any individual or group to control the firm; by early compulsory retirement it makes room for up-grading younger members; by keeping the shares in perpetual circulation among the active partners or their immediate families, there is no possibility for absentee ownership; the fact that retired members receive equal dividends provides additional security for their old age and rewards them for their past efforts with the company—and by allowing them a partial vote it continues to give them some voice in the affairs of the organization.

In discussing the Swedish consulting engineers and their organizations, one cannot overlook the importance they place on the ethical aspects of professional practice. Every member of the Swedish Association of Consulting Engineers must post a bond for 25,000 Swedish Kronor (about $5,000) as his guarantee that he will conform with the code of ethical practices. If it is proved that he has willfully violated this code, he will not only be forced to resign from the Association but will lose his bond as well. It might be added that as yet there have been no cases where members have lost their bonds.

Whether exploring pioneer engineering techniques or dealing with new social, political, or economic concepts, the Swedes have a knack for taking the best out of an idea, giving it a trial run, and then putting it to work to improve their way of life. ▲▲

YOUR NEW PLANT WILL GROW IN THE ERIE AREA



PLANT SITES IN FAIR LAWN...40 MINUTES FROM MANHATTAN

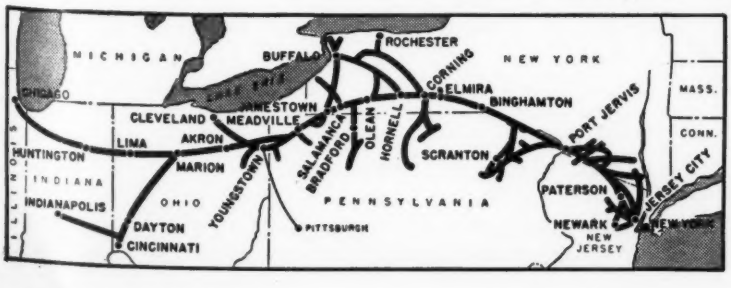
● Here's an air view of choice sites for light industry or warehousing in Fair Lawn, New Jersey—just 12 miles from New York City!

Fair Lawn offers many natural and economic advantages—nationally known firms such as Eastman Kodak, National Biscuit Company have built plants or are building. Gas, electric power, modern sewage disposal and excellent industrial water supplies are available. Modern express highways adjoin the tract. The dependable Erie Railroad offers main-line service between New York, Chicago and connects with other markets.

Fair Lawn offers abundant labor, clerical and technical help, with pleasant community life for your employees. The tax structure is favorable (no state tax on personal or corporate income). For information on Fair Lawn or other choice industrial sites in the Erie Area, mail the coupon below.

Erie Railroad

SERVING THE HEART OF INDUSTRIAL AMERICA



ERIE

D. M. Lynn, Assistant Vice President
Industrial Development
Room 524-F, Erie Railroad
Midland Building, Cleveland 15, Ohio

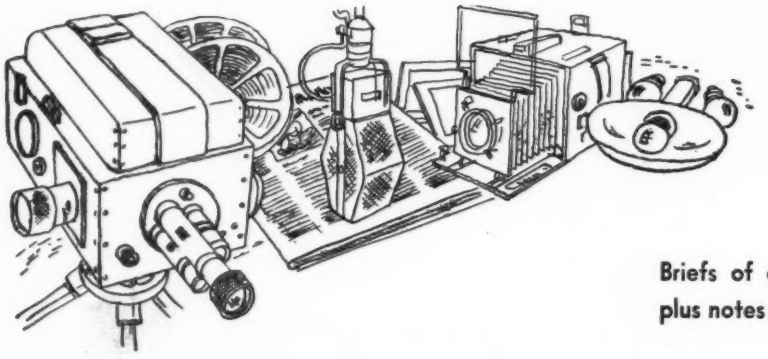
Dear sir: Please furnish us, in strict confidence, additional information about the plant sites described above.

*Name*_____

*Title*_____ *Company*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____



NEWS

Briefs of current interest to the consulting profession plus notes on new equipment in the field of engineering

Above: L. to R., Henry M. Layne, Los Angeles; Charles S. Whitney, Ammann and Whitney; and Dr. Jacob Feld, New York, consulting engineers who spoke at SEAC meeting. Left: L. to R., new president, C. M. Herd, California State Div. of Architecture; retiring president, G. A. Sedgwick, of San Francisco.

Structural Engineers of California Review New Developments in Field

New developments and variations of old methods in structural engineering were discussed at the 24th Annual Convention of the Structural Engineers Association of California, held at Yosemite National Park in October.

William White, executive-secretary of the State Board of Registration, Civil and Professional Engineers, reviewed the legal interpretations and responsibilities of the State Registration Act. Under this Act, no one unless registered as a civil engineer or specifically excepted, may practice or offer to practice civil engineering in any of its branches in the State of California. He noted also that more than 50 violators had been penalized for violations over the past five years. To aid in enforcement, California employs five special investigators who are active in enforcement of the Business and Professions Code, the Civil and Professional Engineers Act, and the Land Surveyors Act.

Carrying responsibilities down to the individual engineer, Lawrason Driscoll, partner of the legal firm of Bronson, Bronson & McKinnon, pointed out that engineers are not protected under the statute of limitations, and that even their estate is not free from suits attempting to establish financial responsibility for engineering failures.

Discussing "Engineering Failures," Dr. Jacob Feld, consulting engineer of New York, noted that literature in this country on structural failures is scanty and suggested that engineers should accumulate a reservoir of literature detailing causes to aid the engineer and ultimately benefit the general public.

Charles S. Whitney, partner, Ammann and Whitney, New York City consulting engineers, speaking on "Thin Shell Concrete Roof Structures," outlined the engineering of a structure with 160 ft side spans of thin shell concrete roof.

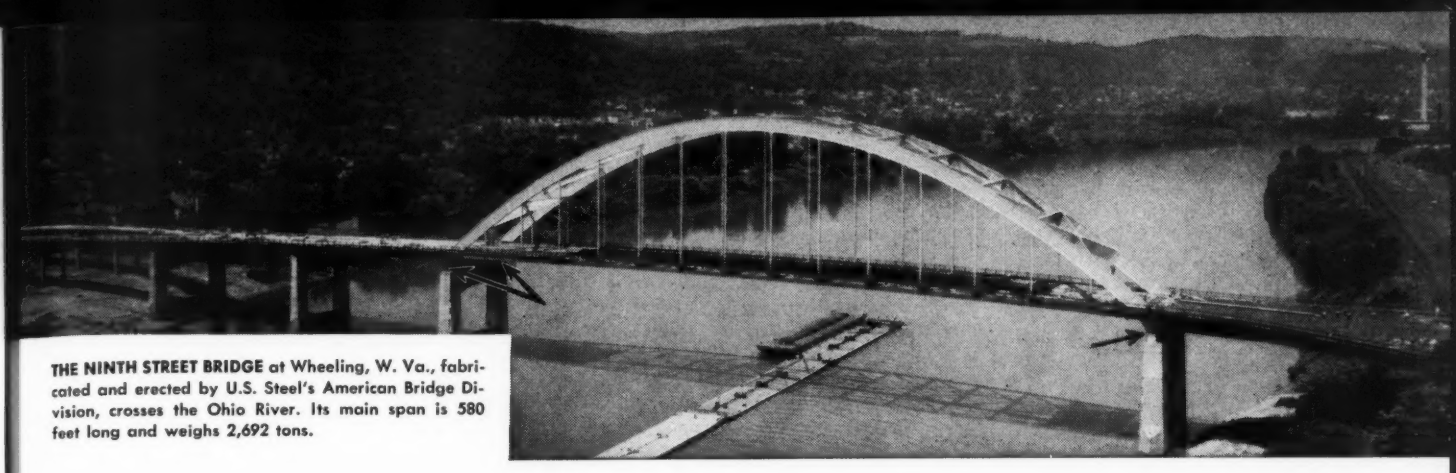
Other speakers and participants included: Dr. Perry Byerly, Director of Seismographic Stations, University of California at Berkeley; Howard Schirmer, of Bethlehem Pacific Coast Steel Corp., and president of the Structural Engineers Association of Northern California; Dr. Lynn Beedle, assistant director of Fritz Engineering Laboratory, Lehigh University; Commander Harry N. Wallin, Maintenance and Materiel Section, Bureau of Yards and Docks; Byron Nishkian, San Francisco consulting engineer; and Henry M. Layne, consulting structural engineer and president of Structural Engineers Association of California.

New Officers elected at the meeting are: president, C. M. Herd, Chief Construction Engineer, State Division of Architecture and president of the Central Association; vice president, William T. Wright, Kistner, Wright & Wright; and secretary-treasurer, J. F. Meehan, District Structural Engineer, State Division of Architecture. G. A. Sedgwick is retiring president.

Consulting Engineering Sessions Planned for ASME Annual Meeting

"The Engineer and the World of Commerce and Industry" will be the theme of the American Society of Mechanical Engineers' Annual Meeting, November 13-18 in Chicago.

Of particular interest to consulting engineers are the Wednesday sessions. At 12:15 PM, there will be a Consulting Engineers Luncheon, with Dr. J. T.



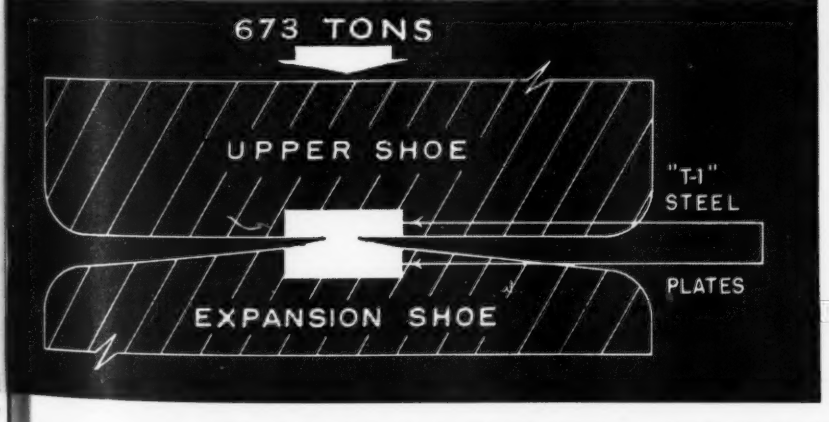
THE NINTH STREET BRIDGE at Wheeling, W. Va., fabricated and erected by U.S. Steel's American Bridge Division, crosses the Ohio River. Its main span is 580 feet long and weighs 2,692 tons.

2,692-ton bridge "see-saws" on 4 knife edges of USS "T-1" steel!

The main arch of the Ninth Street Bridge at Wheeling, W. Va., stretches 580 feet over the Ohio River. The entire weight of this 2,692-ton span rests on 4 thin edges of USS "T-1" steel.

This main span has four arch shoes, each supporting 673 tons. At the greatest point of stress in each shoe is a thin plate of "T-1" steel, machined to a shallow knife edge. "T-1" steel was chosen because it has a minimum yield strength of 90,000 psi, and long life under extreme atmospheric conditions.

On bridge jobs of all types, use "T-1" steel where very *high stresses* are involved and where you need weldability without pre- or post-heating. "T-1" has excellent *impact resistance* at low temperatures. Its very high strength (105,000 psi minimum) makes it ideal for gusset plates, structural members and other component bridge parts.



THE ENTIRE MAIN SPAN rests on four arch shoes like this. Two plates of "T-1" steel are pressed into the heart of each shoe at the contact point. "T-1" steel's 90,000 psi yield strength enables it to withstand the high stress.

LIKE A "SEE-SAW." As the bridge expands laterally, the upper shoe rocks over slightly to relieve expansion stress. The plate in the lower expansion shoe has been machined to a knife edge and acts as a fulcrum for the rocker movement of the upper shoe. This knife edge of "T-1" steel supports 673 tons.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS "T-1" CONSTRUCTIONAL ALLOY STEEL

USS

UNITED STATES STEEL

Retalliata, president of Illinois Institute of Technology, as speaker. At 2:30 PM, two papers on consulting engineering will be presented: "Professional Problems Involved in Submitting Contracts for Engineering Work," and "The Component Parts that Make Up Engineering Costs." The Consulting Engineers' Social Hour is at 5:30 PM.

Among the featured speakers will be Lt. Gen. James H. Doolittle, vice president of Shell Oil Co., New York; Simes T. Hoyt, staff consultant of Castle & Cooke, Ltd., Honolulu; Clyde E. Williams, director of Battelle Memorial Institute, Columbus, Ohio; Philip Sporn, president of American Gas & Electric Services Corp., New York; William Francis Gibbs, president of Gibbs & Cox, Inc., New York; and James M. Todd, consulting engineer, of James M. Todd & Associates, New Orleans, La. (see cover story, this issue).

Meetings will be held at the Congress, Conrad Hilton, and Sheraton-Blackstone Hotels with a concurrent Exposition of Power and Mechanical Engineering at the Chicago Coliseum.

Water Pollution Control Is Everybody's Business

Legislation to control water pollution from industrial wastes and municipal sewage is gaining support from both industry and legislative bodies as it becomes apparent that clean water reduces manufacturing costs and opens new areas for industrial and residential use (see p 46, this issue). In Jacksonville, Florida, the City Commission has been urged by a citizens' advisory group to act "at the earliest possible time consistent with sound financing" to provide funds for $20,460 worth of "first priority" sanitary sewers as the initial step in a four-stage sewerage program to cost more than $109 million over the next 45 years. This is in addition to a 45 year plan for storm drainage facilities to cost $50 million, with a "first priority" expenditure of more than $8 million. The group suggested that the sewer program be financed by revenue bonds payable from project revenues, possibly in the form of an increase in charge for water piped into homes and then out through sewers.

The Washington State Pollution Control Commission has issued a blanket order directing municipalities, industrial firms, and individuals to either treat waste before dumping into Lake Washington or dispose of it otherwise. The five-member commission is a policy making body with authority to require compliance. A similar order had been issued earlier in the year by the commission to reduce pollution of the lower Columbia River.

In Rhode Island, Mount Hope Bay is now nearly free of pollution, according to the New England Interstate Water Pollution Control Commission. Rhode Island and Massachusetts have cooperated on the project. A classification plan for the Taunton River Basin, setting purity standards for various sections of the basin, is scheduled for adoption by the control Commission at its December meeting.

In urging that Missouri and Illinois take steps against pollution of the Mississippi River, the Bi-State Development Agency noted that although the 35-mile stretch of river between Alton Dam and Jefferson Barracks serves as a sewage disposal outlet for a combined population of 1,140,000, industrial wastes account for three times as much pollution as the domestic sewage.

New Equipment and Methods To Be Introduced at Nuclear Congress

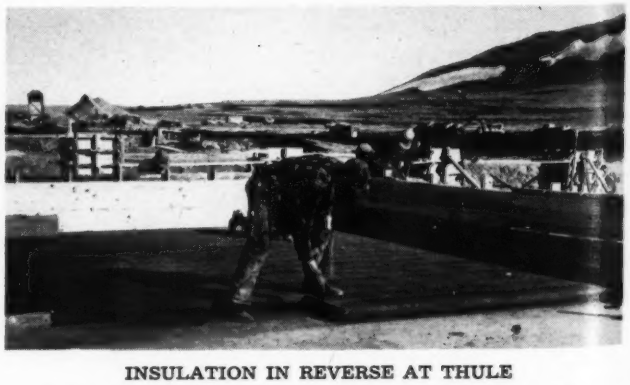
Papers to be presented at the Nuclear Engineering and Science Congress, to be held December 12-16, at the Cleveland Public Auditorium, have been grouped into 50 general topic headings. Serving the consulting engineers' particular fields of interest are topics such as: the "where and how" of atomic power plants with emphasis on safety and selection of site; radiation hazards and their controls; pros and cons of the various power plant types; disposal of radioactive wastes; and radioisotopes and tracer techniques for industry, medicine, and agriculture.

Material presented at the Geneva "Atoms for Peace" conference will not be accepted for repeat presentation at the Cleveland Congress.

While the technical sessions are underway, U. S. and foreign industrial firms will display their wares and technical knowledge at the first International Atomic Exposition in the Auditorium's exhibit halls. The Exposition is sponsored by the American Institute of Chemical Engineers.

Reactor models of the latest design will be shown along with "mechanical hands," closed circuit television, and newly developed alloys. Many types of equipment for peace-time uses of the atom will get their first public showing at the exposition.

Twenty-four engineering societies and trade associations are participating in the meeting, with Engineers Joint Council coordinating arrangements. ▲▲



INSULATION IN REVERSE AT THULE

Concrete will be poured over these four-inch thick blocks of Foamglas insulation to form hanger floor at U. S. Air Force's Thule, Greenland, Air Base. Without insulation, building heat would melt "permafrost" ground causing building to settle and then collapse.

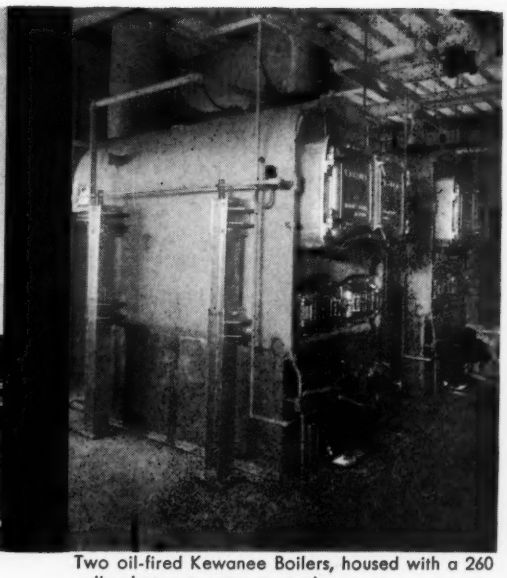
How Kewanee creates "safe weather" for fish...

KEWANEE reserve plus rated boilers

maintain constant temperature

Water temperature is like weather to fish and sudden variations of only a few degrees can be fatal. The problem at Marineland, world's largest oceanarium, Los Angeles County, California, is to meticulously maintain temperatures so its priceless deep sea specimens are not endangered. That's where Kewanee Boilers came in. Cold water from the sea is brought in at the rate of 2,000 gallons per minute. It is vital that boilers offer unfailing service so the inside water temperatures remain constant despite the ceaseless flow of water from the outside. Architects Pereira & Luckman specified Kewanee Reserve Plus Rated Boilers with 50% extra power built-in to take care of fluctuating demands. Only with reserve power could Marineland be sure its rare collection would be protected. And only boilers rated on nominal capacity with built-in reserve could meet the changing demands. So, if your problem is one of maintaining heat against as sharply a defined need as a few degrees change in temperature, or the broad problem of assuring sufficient power when expansion comes, choose Kewanee. You can be sure of unfaltering service.

Marineland Oceanarium, Los Angeles County, California, where rare fish are protected by Kewanee Boilers which assure uniform water temperature. Architects & Engineers: Pereira & Luckman/ Heating Contractor: Mehring & Hanson Company



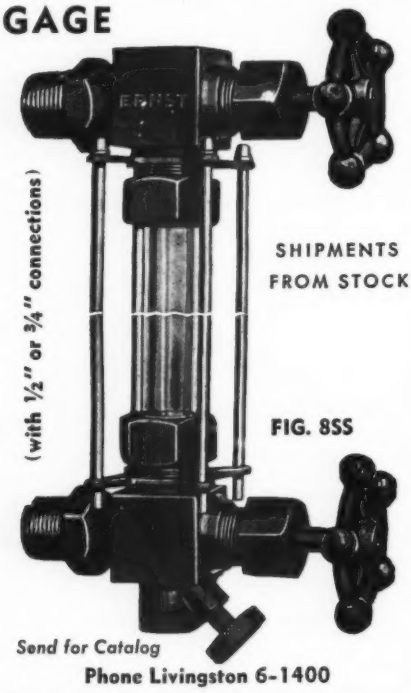
Two oil-fired Kewanee Boilers, housed with a 260 gallon hot water storage tank.

KEWANEE-ROSS CORPORATION, Kewanee, Illinois
Division of American Radiator & Standard Sanitary Corporation

KEWANEE ROSS

Serving home & industry — American-Standard • American Blower • Church Seats & Wall Tile • Detroit Controls • Kewanee Boilers • Ross Exchangers • Sunbeam Air Conditioners

ERNST
STAINLESS STEEL
GAGE



(with ½" or ¾" connections)

SHIPMENTS FROM STOCK

FIG. 8SS

Send for Catalog

Phone Livingston 6-1400

ERNST WATER COLUMN & GAGE CO.
LIVINGSTON, N. J.

MEN IN ENGINEERING

Maurice L. Dickinson, chief hydraulic engineer for Bechtel Corp., has been elected president of the Engineers Club of Los Angeles. Dickinson is in charge of design and construction of Bechtel's numerous hydroelectric projects.

At Ebasco Services, Inc., M. G. Kennedy has been appointed manager of the Sales, Marketing, and Public Relations Department.

Theodore F. Smith has joined Kaiser Engineer Div. of Henry J. Kaiser Company as industry consultant. He will maintain offices at regional headquarters in Pittsburgh.

A new management and industrial engineering consulting organization, Industrial Production Associates Corp., will be headed by George H. Kauffeld, Jr., as president. Offices are at 280 Madison Ave., New York.

New officers of the American Society of Civil Engineers are: president, Enoch R. Needles, senior partner of Howard, Needles, Tammen & Bergendoff; vice presidents, Frank A. Marston, of Metcalf & Eddy, and Glenn W. Holcomb, Dept. of Civil Engineering, Oregon State College.

Dr. George Owen, assistant professor of physics, Johns Hopkins Uni-

Year in, year out DEPENDABILITY

—with

BLACKMER rotary pumps

Cut maintenance costs and delays due to pump failures through these outstanding features:

- self-adjusting for wear vane construction
- replaceable vanes and liner
- self-priming with high suction lift
- wide range of applications

liquid materials handling ®

BLACKMER

Industrial, Hand and Truck Pumps, Strainers, Pressure Control Valves
BLACKMER PUMP COMPANY, GRAND RAPIDS 9, MICH.
DIVISION SALES OFFICES — NEW YORK • ATLANTA • CHICAGO
GRAND RAPIDS • DALLAS • WASHINGTON • SAN FRANCISCO
See Yellow pages for your local sales representative

Handiest Locations in PITTSBURGH

Hotel **Pittsburgher**
PITTSBURGH, PA.
Diamond Street below Grant

Right in the heart of the Golden Triangle—Hotel Pittsburgher

400 outside rooms with bath. Large-screen television and radio at no extra charge in every room. Air conditioning. Two restaurants. *ATlantic 1-6970*

Hotel Pittsburgher MOTEL

Opposite Greater Pittsburgh Airport on Airport Parkway west. 56 air-conditioned rooms with large-screen television at no extra charge, tile bath, private phone. Courtesy car to and from motel.
AMherst 4-5152

a Knott Hotel

JOSEPH F. DUDDY, GEN. MGR.

versity, has joined the scientific staff of Nuclear Consultants, Inc. He will participate in the evaluation of new research programs and industrial projects.

Stephen A. Derry, of the Derry Engineers, will serve as a visiting lecturer in the School of Engineering at North Carolina State College during the coming year.

Nominee for president of the American Society of Heating and Air-Conditioning Engineers is John W. James, vice president of research for McDonnell & Miller, Inc. Other candidates are: first vice president, Peter B. Gordon, of Wolff & Munier Inc.; second vice president, Prof. Elmer R. Queer, Pennsylvania State University; treasurer, Ralph A. Sherman, Battelle Memorial Institute.

Muriel E. Warner, former director of the American Medical Association microbiological laboratory, has joined the staff of Foster D. Snell, Inc. Snell plans to extend its services in the microbiological and pharmaceutical fields.

The American Society of Mechanical Engineers has named seven men to honorary membership: Joseph Bradley Armitage, Kearney & Trecker Corp.; James H. Doolittle, Shell Oil Co.; Samuel Broadus Earle, Clemson College; Simes Thurston Hoyt, Castle & Cooke, Ltd., Honolulu; Carl George Arthur Rosen, Caterpillar Tractor Co.; Philip Sporn, American Gas & Electric Co.; Clyde Elmer Williams, Battelle Memorial Institute.

John T. Baker, chief mechanical engineer and associate in the firm of Haarstick, Lundgren & Associates, of St. Paul, Minn., has entered private practice as a registered professional engineer. The new firm will be known as J. T. Baker & Associate Engineers and will be located at 1835 University Ave., St. Paul 4, Minnesota.

The firm of H. E. Bovay, Jr., consulting engineers, has moved into its own building at 5009 Caroline St., Houston, Texas. The firm will continue to maintain space in the Esperson Bldg. for convenience of clients in the downtown area.

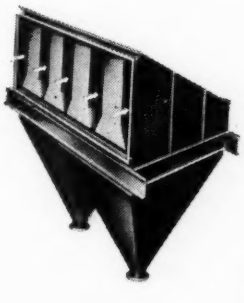
Herbert B. Addington, successor to Myers & Addington, consultants on steam and power, announces removal of his office from New York City to Pleasantville, N. Y.

Wallace Clark & Co., Inc., management consultants, announce election of John W. Barry as vice president, and Robert Galloway and Robert B. Wilson as assistant vice presidents.

Your plant and equipment suffers . . . your community goodwill fades away. These problems can be solved. Prat-Daniel Collectors are designed for the control of industrial dusts and flyash. Multiple small diameter tubes provide powerful centrifugal forces, resulting in sustained high collection efficiency . . . even with ultra-fine dusts.

Whether the problem is industrial dust or flyash, you are assured of satisfaction with P-D Collector Systems, engineered to meet your specific needs.

Write for Reprint No. 102 titled, "What Type Collector?"



pd

Project Engineers
THE THERMIX CORPORATION
GREENWICH, CONN.
(Offices in 38 Principal Cities)
Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Que.; Toronto 5, Ont.

Designers and Manufacturers
PRAT-DANIEL CORPORATION
SOUTH NORWALK, CONN.
POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

ILLCO-WAY
ionXchange

PURIFIES WATER BY REMOVING DISSOLVED SOLIDS

The most *reliable* method of purifying water containing dissolved solids such as calcium carbonate, magnesium sulphate, sodium chloride, silica, or many other common contaminants, is ILLCO-WAY ionXchange (also known as de-ionization). Many adaptations of the basic methods are available including the new mixed-bed de-ionizers which produce water described by one user as of "fantastic purity"

PRACTICAL EQUIPMENT MADE BY "ILLCO-WAY"

Illinois Water Treatment Company has pioneered in the design and manufacture of *practical equipment* for ionXchange processes ever since the first year that the de-ionization idea came out of the laboratories. A wealth of experience has been accumulated so that "ILLCO-WAY" is today recognized as the *leader* in the development of *commercially successful installations.*

ADAPTED FOR PURIFYING RADIOACTIVE WASTES

With the rapid expansion of the field of nuclear science, various needs have developed for ionXchange, particularly in the purification of wastes contaminated by radioactivity. ILLCO-WAY equipment has been designed and built for this and other purposes in several plants employing atomic energy. *For further information on the uses of ILLCO-WAY ionXchange, write . . .*

ILLINOIS WATER TREATMENT CO.
ionXchange
ILLCO-WAY
840 CEDAR ST.
ROCKFORD,
ILLINOIS
NEW YORK OFFICE: 141 E. 44TH ST., NEW YORK 17, N. Y.
CANADIAN DIST. PUMPS & SOFTENERS, LTD. LONDON, ONT.

Notes FROM ABROAD

Pre-Fab Sections Cut Costs

A new method of construction using pre-fabricated cold-rolled steel sections has been developed by the Tube Investments' subsidiary, Metal Sections Ltd. of Birmingham, England. The basic design, as applied to buildings, centers around a three-pin arch made from cold-formed sections, the use of which gives a remarkably high strength per weight ratio. This has been achieved by using stiffeners in the main frame sections at the most appropriate points as shown by a load analysis of the structure. The cold-formed sections are subjected to a constant stress throughout the framework for almost all loads and loading conditions. Under maximum design conditions, each pound of steel that is used supports seven-and-a-half times its own weight and transfers the load directly to the foundations; whereas for other types of buildings in which trusses and purlins rest on load-bearing walls, this ratio goes up to just over 9½.

As delivered on the site, the arches comprise four parts, two rafters and two legs. The bolting together operation takes only 40 minutes per arch for a gang of three men and a mobile crane. Erection of the completed arch is carried out by five men with the help of two mobile cranes and a mobile tower for reaching the apex joint. The manufacturers claim that a building speed of 1000 sq ft per hour can be accomplished by this method.

The lining and insulating system is incorporated in the design of the structural framework. These panels are fitted directly to the framework without any intermediate fixing devices. Lining boards with an insulation blanket stapled to the back are fitted in panels from the outside of the building. This is an advantage as far as roofing is concerned since the lining and insulation can be fitted at the same time as the corrugated roof sheeting and by the same gang of men; interior scaffolding is not necessary. Three men can cover 6000 sq ft of roof or wall per week.

The manufacturers state that the advantages of the Metsec method of building are that it cuts the time required, compared with general methods, by at least 30 percent; that the high strength per weight ratio results in savings in steelwork amounting to as much as 40 percent over that needed in conventional structures; and that compared with other finished buildings of equivalent specification, the system shows an advantage of at least 10 percent savings in total cost. This construction technique can be applied to many different types of buildings.

German Consultants Look Abroad

Twelve German consulting engineering firms have established themselves as a private group to participate in consulting work abroad. This group, similar in some respects to the Dutch NEDECO (Netherlands Engineering Consultants) and the Norwegian NORENO (Norwegian Export Organization), has also been officially recognized by the World Bank and will be considered for en-

. . . special to consulting engineer

gineering assignments in connection with projects being financed by the Bank. The twelve constituent firms are consultants in the strictest sense of the word and have no commercial or business ties. They are all members of the German Association of Consulting Engineers and are subject to the Association's code of professional rules and ethics. The Germans feel that by combining their talents and facilities they will be in a much better position to compete for foreign jobs.

Power Cost Comparisons

At the Tenth International Union of Producers and Distributors of Electrical Energy, in London, some interesting comparisons for different countries between the cost of transporting coal to a local power station as against transmitting electricity an equivalent distance were given by Mr. R. Conrad of the French power syndicate, Electricite de France. Examination of the available figures had shown, he said, that the transmission of electric power at 225 kv was less economical in France than the direct transportation of good-quality coal.

Results in Belgium were very similar to those in the French case. In the U.K., on the other hand, the moderate cost of coal per unit of usable heat stored in it at the pithead, and the relatively high rail transport costs, make transmission of electrical energy by means of an electrical grid more economical. The use of a 275

These four 30′ x 60′ silos are used by a pulp and paper mill for handling and storing wood chips.

We have erected silo-type bins at hundreds of plants to handle and store bulk materials peculiar to their industries. A few examples are—grain for the milling industry; clay, silica sand, and feldspar for the ceramic industry; ore for the metal industries; molding sand for the foundry industry; cottonseed and soybeans for the vegetable oil industry.

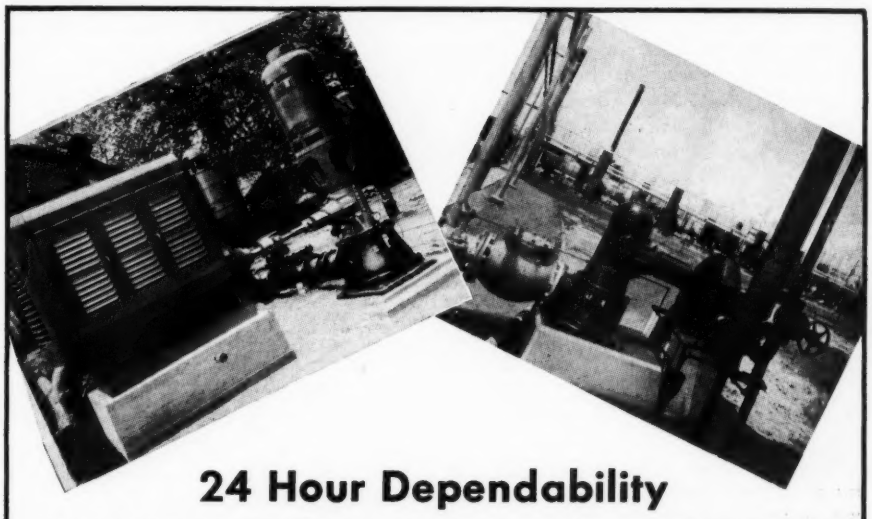
Designing handling and storage systems for around 100 kinds of materials has given us a wealth of experience which is at your disposal. You are invited to write, wire, or phone us.

Not exported except to Canada and Mexico

THE NEFF & FRY CO.

302 ELM STREET • CAMDEN, OHIO

SUPER-CONCRETE STAVE STORAGE BINS



24 Hour Dependability

JOHNSON *Right Angle* DRIVES

Municipal and Industrial Coverage

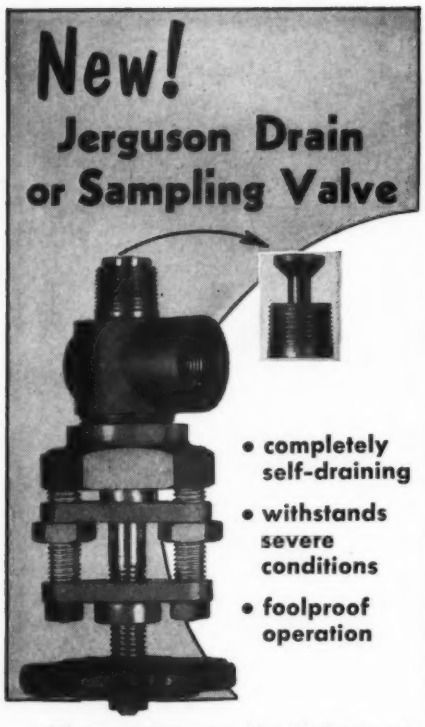
For Water Supply • Flood Control • Sewage

TYPE	DESIGN
Engine and Turbine Driven	Hollow and
Combination and Dual	Solid Shaft

Illustrated Engineering Catalogs On Request

JOHNSON GEAR & MANUFACTURING CO.

Main Offices and Works • Berkeley 10, California



The new Jerguson No. 23 Drain or Sampling Valve is completely self draining, for the valve stem seats on the outside of the valve body. It is ideal for installations where it is desirable to have the valve seat inside the wall of a vessel in order to prevent the typical condition of liquid remaining in the nipple and valve inlet.

This rugged, new Jerguson Valve has outside screw and yoke construction to meet high temperature or corrosive conditions where inside threads cannot be tolerated. The efficient outside thread design eliminates possible freezing and allows the valve stem to work freely at all times. The No. 23 Valve provides foolproof operation because the stem is constructed with a left-hand thread, thus allowing the valve handle to operate in the normal direction of standard valves.

The No. 23 is recommended for pressures up to 4000 lbs. @ 100° F. or 1000 lbs. @ 750° F. Standard with ¾" N.P.T. Male inlet and ¾" N.P.T. Female outlet. Optional features include construction with an additional connection for such uses as a steaming out line, or with a reamer on the end of the stem to break away encrusted matter which may have collected on the inside vessel wall.

Write for data unit and complete details.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.
Offices in Major Cities
Jerguson Trees Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

kv system would, Mr. Conrad declared, make the grid system for transporting electricity in Britain even more economical.

The high cost of coal per unit of usable heat stored in it at the point of delivery in Italy also meant that the transmission of electricity was a more economical method of producing electric power at a given locality than that of transporting coal to a local power station.

Yugoslavs Buy Soviet A-Reactor

Cvetozar Vukmanovic, Vice-President of Yugoslavia in charge of economy, has just concluded new trade arrangements with the Soviet Union under which Yugoslavia will receive an atomic reactor from Russia next year. Mr. Vukmanovic said that the Soviet Union has offered to deliver the reactor in 1956 under terms which will allow the Yugoslavians two years to pay for it.

British Contractors

Official figures for the year ending March, 1955 show that British civil engineering contractors and their associated firms have expanded their foreign construction work to a new level of about $200 million annually. Only two or three years ago foreign construction was averaging between $85 and $140 million.

A large proportion of the work done last year — about $62 million — was in Africa, excluding Egypt and the Sudan. Next to Africa, the main work load was in the Middle East oil states. One of the biggest jobs in this area is an $84 million program of road modernization for the Persian government recently awarded to a U. K. contractor. In Australia and New Zealand, the Far East, South America, and Canada, the amount of work being done by British contractors is either being maintained or increased.

The main problems facing British contractors is the increasing pressure of foreign competition, the financial difficulties experienced by governments in underdeveloped countries, and, in some cases, to a shortage at home of skilled staff men to send abroad. The competition in the Middle East comes mainly from French and German firms. In South America, Continental and American contractors are giving the English considerable competition. The British are also finding an intensified amount of activity by foreign firms for civil engineering work in Africa.

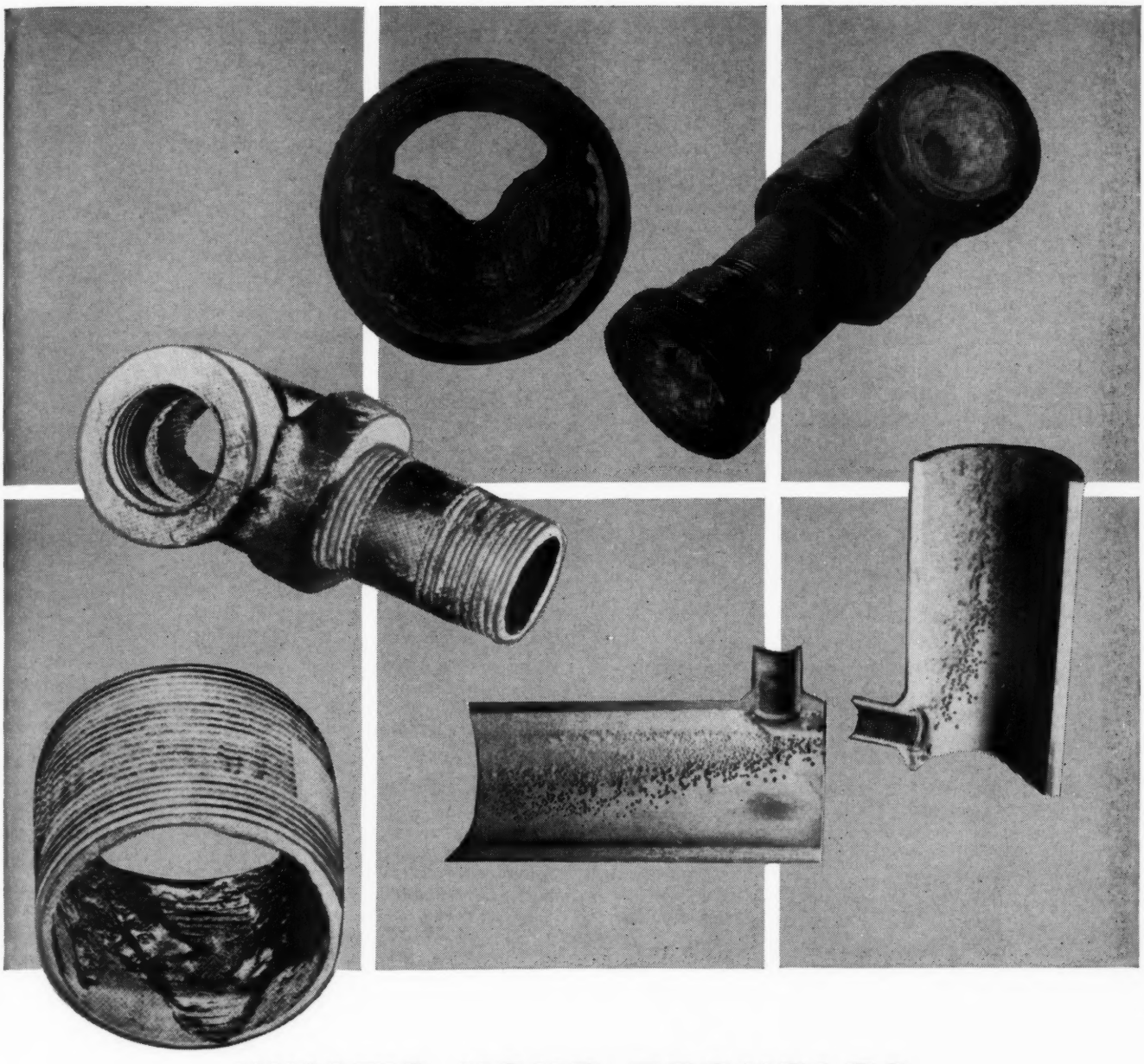
It is expected that British interests will play a major part in Egyptian development programs. Three British concerns — including a civil engineering contractor—have recently joined an international consortium of French and German companies ready to bid for the Egyptian High Dam project on the Nile. The estimated cost of the scheme is some $600 million. An Egyptian mission has been in London contacting U. K. consulting engineers about the project and it is likely that a start will soon be made on detailed plans for the dam.

International Fair

Nineteen free world nations will exhibit at the 125-acre Dominican Republic International Fair for Peace and Progress in Ciudad Trujillo, December 20-February 27. Exhibits will cover Dominican and foreign industry, agriculture, trade, medicine, chemistry, science, and electronics, including atoms-for-peace models.

Foreign Projects

The contract for design, engineering, procurement, and inspection during construction services for the modernization and expansion of Nicaragua's existing electrical distribution system in Managua has been awarded to The Kuljian Corp. by the Empresa Nacional de Luz y Fuerza. This is in addition to the contract with Kuljian for design and engineering of the 30,000 kw power plant at Managua.



WHAT'S YOUR TROUBLE?

Each of these destroyed parts had to be taken out of service because of incomplete or inadequate water treatment. Replacement meant loss of steam production . . . new equipment expense . . . added labor-repair costs.

DEARBORN COMPLETE WATER TREATMENT SERVICE eliminates this by providing trouble-free water—a vital necessity to every user of industrial steam. Dearborn's many years of leadership in the field of water treatment will help keep your power plant operating economically.

CALL ON YOUR DEARBORN SALES ENGINEER for (1) analysis of raw water (2) recommendation of test procedures (3) proper treatment (4) a manually or automatically controlled feeding system.

Dearborn®

combatting corrosion wherever it occurs

Dearborn Chemical Company
Merchandise Mart Plaza, Dept. CE
Chicago 54, Ill.

Please send me
- ☐ Internal Treatment Bulletin 5000
- ☐ Filmeen Bulletin 5013-A
- ☐ Dearborn "659" Bulletin 5008
- ☐ Have a Dearborn Sales Engineer call.

Name.....

Company.....

Position.....

Address.....

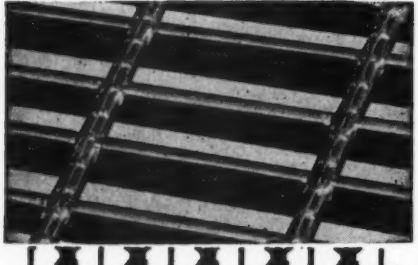
City..... *Zone*..... *State*.....

You Get
MORE THAN GRATING
When You
SPECIFY IRVING

YOU GET...
Over 50 years of engineering skill and production know-how from the FOUNDERS of the open-grid flooring industry.

YOU GET...
A "fitting" grating for every purpose.

YOU GET...
Riveted, pressure-locked and welded Irving gratings in steel; and Irving aluminum gratings in riveted and pressure-locked types, designed for your industrial flooring problems.

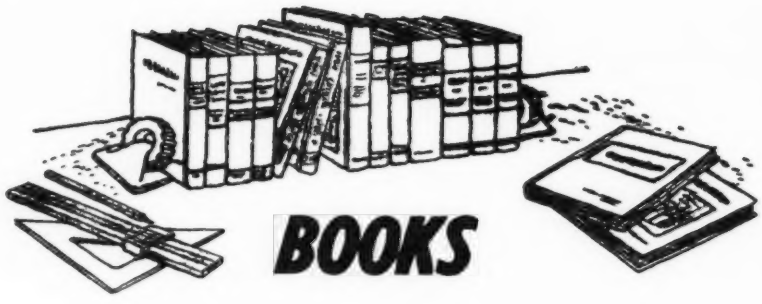


YOU GET...
Irving engineering procedures which assure precisely fabricated panels designed from your floor plan or sketch for quick, easy installation.

YOU GET...
Prompt delivery anywhere.

IRVING SUBWAY GRATING CO., INC.
ESTABLISHED 1902

OFFICES and PLANTS at
5056 27th St., Long Island City 1, N.Y.
1856 10th St., Oakland 20, California



TO ORDER BOOKS

As a readers' service, CONSULTING ENGINEER will order reviewed books or any other technical volumes you need. In ordering books, give title, author, and publisher and enclose check. We will also suggest titles of books on any technical subject and order for you at regular publishers' prices.

LIFT SLAB ENGINEERING MANUAL, United States Lift Slab Corporation; Paper bound; $5.00.

Reviewed by Gilbert Rowe
Lyles, Bissett, Carlisle & Wolff

The Lift Slab Engineering Manual deals with a specific method of construction and is written exclusively for architects and engineers. Its value to the consulting engineer is inherent.

The book contains statistical data and background of lift slab construction; a description of the lifting equipment and its functions; the structural design, covering economy of lifting, typical problems, with solutions; the practical aspects which include suggestions for lifting slabs in buildings up to five stories.

The singleness of purpose in furnishing the architect and engineer adequate information is reflected in the completeness with which the subject is covered.

The manual has been edited by competent engineers. The structural analysis is reconciled with accepted engineering practice, particularly with the American Concrete Institute Building Code.

The structural design shown in the book is the same as any flat slab conventional concrete frame with the following exceptions: The use of the Euler column formula for columns fixed at the base and free at the top is necessary due to lifting. The live load moments only are effected by column stiffness, the design of the pour strip, and the design of the bracing during lifting.

The fact that columns do not have to be evenly spaced or lined up might have been included, and will probably be covered in an addenda. This flexibility would have particular appeal to the architect.

The book suggests the use of paper tubes or fillers. It would have been well to have added that when such tubes are used they have to be anchored to keep them from floating to the top.

While the book gives the architect and engineer adequate information to evaluate this type of construction, it is not dogmatic. The engineer is given the solution to typical problems which can be an excellent point of departure in solving his own problems. Most structural engineers prefer this style of presentation.

ALSO AVAILABLE

The following six volumes have been prepared by U. S. Atomic Energy Commission and published by McGraw-Hill Book Co. Price of the set is $62.00:

RESEARCH REACTORS, 406 pp, $6.50.
REACTOR HANDBOOK: PHYSICS, 804 pp, $12.00.
REACTOR HANDBOOK: ENGINEERING, 1088 pp, $15.00.
REACTOR HANDBOOK: MATERIALS, 614 pp, $10.50.
NEUTRON CROSS SECTIONS, 363 pp, $12.00.
CHEMICAL PROCESSING AND EQUIPMENT, 316 pp, $6.00.

Expert Witness Reprint
Robin Beach's five articles on "The Engineer as an Expert Witness" are available in a 16-page reprint for $1.00. Please write to: Reader Service Dept., CONSULTING ENGINEER, 227 Wayne St., St. Joseph, Mich.

The 110'6" debutanizer shown above and the 150-ton unit (below), a 3-stage axial flow compressor, are typical Newport News products. Whether you need a hydraulic turbine, vacuum tanks or penstocks . . . bridge caissons, digesters or dryer rolls . . . you can command the services of Newport News for units of about any size or shape.

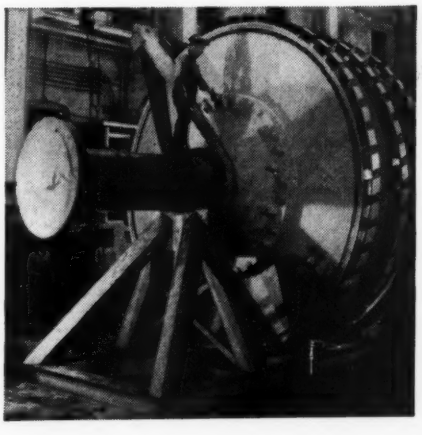
Newport News builds wide variety of large units

ALMOST ANY TYPE of heavy equipment can be built by Newport News.

And the reason? Specialized production techniques for one thing. You get the benefit of plant methods and equipment developed as a result of Newport News' seven decades of experience. Seven decades fabricating millions of tons of steel . . . carbon, corrosion-resistant alloy, clad and other special steels.

Moreover, Newport News' plant provides unsurpassed facilities. More than 225 acres in area, it comprises vast steel fabricating shops, five huge machine shops, acres of pattern shops and foundries. It includes forge and die shops, heat treating furnaces and allied equipment, along with complete modern test apparatus.

But most important of all . . . it is the high integration of skill and production facilities that enables Newport News to build large units fast . . . to save valuable time. Let us bid on your present or future projects. Write today for your copy of our illustrated booklet "Facilities and Products."

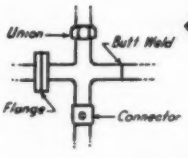


Engineers — Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.

Newport News Shipbuilding and Dry Dock Company
Newport News, Virginia

THE NEW STANDARD IN PIPELINE ECONOMY

Speedline® STAINLESS STEEL FITTINGS SIMPLIFY PIPELINE DESIGN!



FITTING IS ADAPTABLE . . . YOU SELECT THE TYPE OF JOINT

- Simple layouts require fewer design hours
- Versatility permits reduced inventory
- Expanding feature saves time, money . . . eliminates need for costly tools

Details of the greater design flexibility possible with Speedline Fittings—at lower cost—are contained in this new illustrated catalog. Write for a copy today. There's no obligation.

®SPEEDLINE is a registered Horace T. Potts Co. trademark

Distributors are located in principal cities from coast to coast

Speedline® STAINLESS STEEL FITTINGS

manufactured by **HORACE T. POTTS COMPANY**

522 East Erie Avenue • Philadelphia 34, Pa.

WELCOME TRAVELERS to NEW

KANSAS CITIAN HOTEL

400 ROOMS 400 BATHS

EASY PARKING

for comfort, convenience, economy . . . you won't find a better hotel value! Coffee Shop; Bleacher Room with nightly entertainment; easy parking.

from $3.50 single with bath

150 Rooms Air-conditioned

Absolutely Fireproof

KANSAS CITY MO.

12th at Broadway

Home of the Ball Park Room, the only Indoor Park in the World

Affiliated Weinberg Hotels

LANKERSHIM, Los Angeles • CAPITOL, Amarillo

Plant Location Problems

—Starts on page 34

Before the atomic era was ushered in by World War II, there had been noticeable migrations of industry in search of better labor conditions, economical materials, and new markets. Besides, there was the tendency to decentralize, influenced by considerations of company policy, management, and operating efficiency. Since the advent of atomic warfare, the Government has used its influence, supported by financial assistance, to encourage the decentralization of defense industries, most of which are clustered around the larger industrial centers.[2] However, private industry has shown little interest in building plants in locations selected on the basis of defense considerations where these conflict with economical production and distribution of products, though some have considered this aspect.

Need for Better Public Relations

State development commissions and local organizations advertise the state's industrial advantages and actively solicit industrial prospects. Public officials profess their intention to do everything they can to promote local industrial development. At the same time, we have the anomalous spectacle of congressional delegations from these same states, under the influence of professional labor agitators and spurious economists, voting solidly for measures that are opposed by business interests and taking part in the attack on the integrity of business men, in general, for purely political purposes. There is something wrong with this picture. More people need to be informed about what it takes to produce and maintain jobs and prosperity.

Perhaps one indirect benefit to be derived from the current active campaign to attract industries to almost every part of the country will be an aroused consciousness of what is needed to make these industries prosper.

Underlying the numerous reasons given for moving manufacturing plants or for selecting one place or another as the best location for a new plant is the desire of industry to escape from present conflicts with labor agitators and predatory politicians. Furthermore, industry seeks a home where its neighbors will welcome it as a productive element in the community, an asset to provide better income and better living for people who work, and a support for institutions that are needed to insure health and happiness. The preference for smaller places is governed largely by these incentives. Industry can pay fair wages and reasonable taxes only in return for fair treatment by local authorities and friendly cooperation from local citizens. ▲▲

---

(2) "The Need for Industrial Dispersal," U.S. Senate Document No. 55, 1951, "National Security Factors in Industrial Location," Nat. Security Resources Board, 1948.